Science and Technology

Program Mission

Science and Technology is a national program that provides the full range of capabilities from directed research through technical and deployment assistance, in partnership with other Environmental Management programs, to provide fully integrated, technically defensible solutions for cleanup and long-term stewardship at DOE sites.

Program Goal

The goal of Science and Technology is to provide users with the most efficient, effective environmental cleanup technologies and technical solutions possible and on a schedule that enables achieving cleanup and bringing into compliance most of the DOE complex by 2006. This will be accomplished through investment in the Science and Technology program that is planned and managed in an interactive, coordinated, participatory relationship with Environmental Management cleanup project managers and stakeholders. The program, which represents the majority of DOE's Environmental Quality Business Line Research and Development Portfolio, supports basic through applied research, technology development and demonstration, and technical assistance to support deployment, and will draw from the best available technical expertise.

These activities, for which funds are requested, directly support goals outlined in the *Accelerating Cleanup: Paths to Closure* in which over 500 technology needs were identified with 86 pathways or events on the critical path to closure with medium to high technology risk, and over 200 waste streams with medium to high technology risk.

Program Objectives

- **To focus science and technology research and development on DOE's high priority needs** -- Conduct scientific research and technology development through "focus areas" on highest priority end-user needs identified by the sites: Mixed Waste Characterization, Treatment and Disposal; Radioactive Tank Waste Remediation; Subsurface Contaminants; Deactivation and Decommissioning; and Plutonium Stabilization and Disposition. Needs are prioritized within each site as well as nationally to ensure work is focused on the problems with the biggest impact.
- **To invest technology development funding to reduce major costs and uncertainties** -- Direct funds to activities where the potential for significant cost reduction is high.
- **To Reduce EM's technological risk** -- Direct funds to activities that reduce programmatic risk associated with technical uncertainties that exist in the critical path to site closure.

- **To facilitate accelerated deployment of cost- and schedule-reducing alternative technology** -- Involve customers in all phases of Science and Technology planning and decision making activities and bridge the gap between development and use to ensure that new technology is rapidly deployed through site-based assistance at the sites, including sponsoring accelerated site technology deployment projects that will provide valuable documentation of performance.
- **To develop and implement a targeted scientific research agenda** -- Conduct, in partnership with DOE's Office of Science and in tandem with the "focus areas," a long-term basic research program that will result in transformational or breakthrough approaches for solving the Department's most intractable environmental problems, such as the subsurface contaminants in the vadose zone and groundwater.

Performance Measures

The success of the Science and Technology program is currently measured by:

- The number of technologies or technology systems (30) demonstrated that meet performance specification-based needs as identified by the Site Technology Coordinating Groups.
- The number of technologies or technology systems (30) made available for implementation with cost and engineering performance data.
- The number of deployments (60) of alternative technology in cleanup activities, an Environmental Management corporate measure shared by the EM user organizations, which are responsible for technology selections.

Significant Accomplishments and Program Shifts

- Implement an Environmental Management Research and Development Program Plan that “maps” investments in solutions to project manager identified needs. Extend Science and Technology program’s role to provide the full range of resources and capabilities needed to deliver and support fully developed, deployable solutions from basic research through deployment.
- Disseminate research results from early successes of researchers funded through the Environmental Management Science Program. Continue support of quality scientific resources both in the United States and internationally. Scientists that have been funded through the Environmental Management Science Program are currently conducting research at 89 universities, 13 Department of Energy laboratories, and 21 other governmental and private laboratories. These are located in 37 states and the District of Columbia, Canada, Australia, Russia and the Czech Republic. Of the 235 research awards, 126 are collaborative efforts involving funding at two or more institutions.
- Issue scientific research awards in FY 1999 in the areas of subsurface contamination/vadose zone and effects of low dose radiation. Research focused on subsurface contamination/vadose zone issues will assist the Department in addressing problems identified at the Hanford site and other DOE sites with

similar problems. Research on the effects of low dose radiation will help to identify potential health and ecological effects from exposures and risks from low dose radiation.

- # Complete, in FY 1999, development and demonstration of alternatives to open flame combustion high temperature treatment (i.e., incineration). These technologies support facility compliance at 6 states and can address approximately 5,400 m^3 of mixed low-level and transuranic waste.
- # Increase work, in FY 1999, for the stabilization and in situ remediation of contamination in the vadose zone and groundwater, including work to provide bioremediation and natural attenuation technologies to avoid costly and risky excavation, ex situ treatment and offsite disposal.
- # Continue, in FY 1999, multi-year tasks performed in cooperation with the Environmental Protection Agency to improve landfill caps, covers, and barriers to prevent the migration of wastes from DOE sites. The Environmental Protection Agency will incorporate the data from these successful demonstrations into national landfill cover design guidance.
- # Expect to complete, in FY 2000, a Large Scale Demonstration and Deployment Project initiated in FY 1998 in cooperation with the EM Environmental Restoration program to deactivate and decontaminate a tritium production facility at Mound. This Large Scale Demonstration and Deployment Project will showcase 8 - 12 innovative technologies for remote characterization and decontamination and dismantlement of tritium-contaminated equipment and surfaces.
- # Deploy, in FY 1999, a system (Pulsed Air Mixing) that will introduce pulses of air at the bottom of Gunite and Associate Tank W-9 in order to mobilize the thick sludge that rests at the bottom, a problem in a number of DOE radioactive waste storage tanks. The Pulsed Air Mixing system is now part of Oak Ridge Reservation's Waste Conditioning System.
- # Assume lead, in FY 1999, for the Plutonium Stabilization and Disposition Focus Area, formerly located within the Environmental Management Nuclear Material and Facility Stabilization Program.
- # Complete multi-year Technology Deployment Initiative site cleanup projects that were initiated in FY 1998 and continue accelerated site technology deployment projects initiated in FY 1999. These deployment projects, which were selected competitively based on a multi-application performance specification, are designed to accelerate widespread deployment of innovative technologies by providing proof of performance documentation. Aggressive use of the alternative technologies in which the Department has invested optimizes the cost savings they enable. In FY 2000 deployment assistance is considered an integral Focus Area function, rather than a separate program.

Uncertainties are inherent in any research program, and the allocations of funding requested below represent the best estimates at the time this budget was formulated. It is possible that as circumstances change, or new higher-priority risks are identified by the site, it may be necessary to redirect funds within the Science and Technology program categories to accommodate these changes..

The proposed funding for the Science and Technology program is summarized below.

FY 2000 Budget Summary [a]

	(dollars in thousands)		
	FY 1998	FY 1999	FY 2000
Mixed Waste, Characterization, Treatment and Disposal Focus Area	38,934	19,990	23,404

The Mixed Waste, Characterization, Treatment, and Disposal Focus Area provides technical and engineering solutions for supporting effective, efficient mixed Waste treatment technology systems. Site Treatment Plans identified 165,000 m^3 of mixed and transuranic waste in storage that includes over 2,300 mixed waste streams at 36 sites. *Accelerating Cleanup: Paths to Closure* has identified 21 high priority technology needs in the mixed and transuranic waste areas. It also identified 34 waste streams with high technology risk. Ten of 48 pathways/events on the critical path pose high technology risk. With the funding provided, this Focus Area will assist in the deployment of alternative technologies at individual sites and implement and maintain sound program management and integration processes. The Mixed Waste, Characterization, Treatment, and Disposal Focus Area includes the following systems:

Material Handling and Characterization Solutions (FY 2000 funding $18,209,000) are being developed to characterize radionuclide components in boxes destined for disposal at Waste Isolation Pilot Plant or other subtitle C facility, to enhance payload capacity of transuranic waste containers, and to develop automated handling systems for mixed waste material during characterization, treatment, packaging, and disposal.

Non-Thermal Treatment Solutions (FY 2000 funding $5,195,000) are being developed as an alternative to high temperature treatment systems because of the low risk and high regulatory and public acceptance. Activities will include alternative oxidation technology treatment and stabilization alternatives for plutonium 238 contaminated waste and polychlorinated biphenyl mixed waste.

[a] The following nine pages are a synopsis of the budget request for the Office of Science and Technology and is provided for ancillary information.

	(dollars in thousands)		
	FY 1998	FY 1999	FY 2000
Radioactive Tank Waste Remediation Focus Area	52,513	41,676	48,847

The Radioactive Tank Waste Remediation Focus Area addresses 34 high priority needs in the development and deployment of technologies to remove high-level waste in over 270 large radioactive and other miscellaneous underground storage tanks across DOE containing over 90 million gallons of waste (nine waste streams with high technology risks), and prepare it for final disposal. Closure of these tanks will mitigate further risks to ground water and surrounding populations, and contribute significantly to mortgage reduction. Within the funding provided, the Radioactive Tank Waste Remediation Focus Area will assist individual sites in the deployment of alternative technologies to reduce risk and cost, and accelerate cleanup at those sites. The Radioactive Tank Waste Remediation Focus Area includes the following activities:

Tank Waste Retrieval and Closure (FY 2000 funding $19,744,000) will focus on techniques to ensure tank integrity prior to and during retrieval operations, which includes tank inspection, corrosion monitoring, saltcake dissolution and sludge heel retrieval, and ultimate tank closure at Idaho, Oak Ridge, Savannah River, and Richland. Activities related to the Hanford Tank Initiative will be continued at a reduced level under the Tank Waste Retrieval and Closure Product Line.

Tank Waste Pretreatment and Immobilization (FY 2000 funding $29,103,000) will be developed and deployed to further optimize high-level waste glass loadings and performance and melter design, provide alternative paths to salt waste treatment to replace in tank precipitation, improve slurry and waste feed preparation, and minimize the volume and corresponding disposal cost of high-level and low-level waste forms to be produced.

	(dollars in thousands)		
	FY 1998	FY 1999	FY 2000
Subsurface Contaminants Focus Area	32,870	31,611	35,080

The Subsurface Contaminants Focus Area addresses technological solutions for the 5,700 known DOE ground water plumes that involve 475 billion gallons of contaminated water and 75 million m^3 of contaminated soil. There is an additional 3 million m^3 of leaking wastes buried in landfills, trenches, and spill areas. The *Accelerating Cleanup: Paths to Closure* has identified 57 high priority needs, 25 waste streams with high technology risk and 42 of 281 pathways/events on the critical path with high technology risk within the Environmental Restoration problem area. The Subsurface Contaminants Focus Area currently encompasses three problem areas to address these needs, organic solvent remediation, containment (barriers caps and covers), and metal and radionuclide plumes. Within the funding provided, this Focus Area will assist individual sites in the deployment of alternative technologies to reduce risk and cost, and accelerate cleanup at those sites. The Subsurface Contaminants Focus Area includes the following activities:

Dense Non-Aqueous Phase Liquids (FY 2000 funding $18,829,000) constitute a generic class of particularly difficult to locate, quantify, and treat or destroy organics that contaminate both the vadose and saturated zones at many DOE sites. Activities will focus on better understanding the long term movement and fate of these contaminants to better design treatment strategies. Treatment systems will be demonstrated and deployed, including advanced bioremediation and natural attenuation, in situ passive and reactive barriers, and in situ treatment technologies applicable to a broad range of geologies in the vadose and saturated zones, including deep access.

Source Term Containment/Source Term Remediation (FY 2000 funding $5,372,000) prevents the further spread of contaminants to limit associated risks and cleanup costs. Technologies for deep barrier placement, improved longer life surface caps, landfill hot spot removal or stabilization, and verification monitoring will be demonstrated and deployed.

Metals and Radionuclides in the Vadose and Saturated Zones (FY 2000 funding $10,879,000) cannot be destroyed and therefore, must be either stabilized or removed. Efforts will continue to develop improved characterization, monitoring and modeling techniques and to verify the performance of reactive and passive barrier systems at Rocky Flats and Oak Ridge. Technologies will be deployed to chemically stabilize or remove contaminants at Hanford, Mound and Albuquerque.

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
Deactivation and Decommissioning Focus Area	29,466	22,938	17,112

The Deactivation and Decommissioning Focus Area develops, demonstrates, and facilitates implementation and deployment of efficient and cost effective technologies through a series of Large Scale Demonstration Projects which address real needs pertaining to the 20,000 radiologically/hazardous waste contaminated buildings and facilities. The near-term goal is to reduce the EM deactivation and decommissioning mortgage of $4 billion through FY 2006 by 25% or a net reduction of approximately $1 billion. Within the funding provided, this focus area will assist individual sites in the deployment of alternative technologies to reduce risk and cost, and accelerate cleanup at these sites. The *Accelerating Cleanup: Paths to Closure* has identified 34 high priority needs. Eleven of 30 pathways/events are on the critical path with high technology risk. The Large Scale Demonstration Projects include:

Reactor Facilities (FY 2000 funding $4,733,000) technologies will be demonstrated and deployed to address underwater visual inspection, characterization and dismantlement, as well as removal and treatment of highly contaminated fuel pool sludges, debris and water. Technologies to facilitate decontamination and decommissioning of the 14 surplus production reactors across the DOE complex to a degree such that they can be put in interim safe storage for up to 50 years will be demonstrated and deployed.

Radionuclide Separation Facilities (FY 2000 funding $6,525,000) Improved technologies are required to deactivate and decommission radionuclide separation facilities, including gaseous diffusion plants, chemical separation facilities, uranium recycling facilities, lithium enrichment facilities, heavy water production facilities and tritium production facilities. Technologies to characterize, separate and decontaminate metals for internal DOE recycle or free release will be demonstrated and deployed.

Fuel and Weapons Component Fabrication Facilities (FY 2000 funding $5,854,000) Improved and innovative technologies are required to deactivate and decommission fuel and weapons component fabrication facilities including uranium milling and refining facilities, fuel and target fabrication facilities, weapons component fabrication facilities and weapons assembly, dismantlement, modification and maintenance facilities. Improved and innovative technologies will be demonstrated and deployed to address building deactivation and decommissioning and metal/concrete waste disposal/recycling at tritium contaminated facilities.

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
Plutonium Stabilization and Disposition Focus Area	0	5,480	4,253

The Plutonium Stabilization and Disposition Focus Area will be operating under the aegis of the Office of Science and Technology beginning in FY 1999. The program operated under the Office of Nuclear Material and Facility Stabilization since its inception in FY 1995. The program addresses the technology needs associated with the stabilization and disposition of plutonium and other fissile materials and address the Secretarial commitments pursuant to the Defense Nuclear Safety Board recommendations as well as other safety vulnerability studies. *Accelerating Cleanup: Paths to Closure* has identified 21 high priority needs in the nuclear materials problem area. Four of 19 pathways/events on the critical path pose high technology risk. Within the funding provided, this Focus Area will assist individual sites in the deployment of alternative technologies to reduce risk, cost, and accelerate cleanup at these sites.

Plutonium Stabilization Technology Development (FY 2000 funding of $3,653,000) will develop improved processes to stabilize plutonium (approximately 20 metric tons) left in the weapons production pipelines in various storage configurations and plutonium residues (approximately 150 metric tons).

Alternative Stabilization Process for Fissile Materials Solutions (FY 2000 funding of $600,000) Will test waste solution containing americium and curium for absorption on porous crystalline matrix and support the Savannah River Site in scale-up tests with actual americium and curium solution.

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
University Programs	21,605	19,215	14,900

Universities provide a unique opportunity to cooperate with the academic community in the development of fundamental data related to the application of technology development and the follow-up activities related to the resolution of technical issues and system optimization. Attention is given to providing credible data, from non-conflicted, recognized experts in support of activities related to the acceptance of innovative technologies by the regulators and stakeholders.

Florida State University (FY 2000 funding $1,900,000) in partnership with Eastern and Central European Institutes are evaluating the transfer of European technologies to solve DOE cleanup problems.

Mississippi State University (FY 2000 funding $4,000,000) continues its support to the Focus Areas in the development of monitors for thermal treatment of mixed waste and development of sensors to measure high-level waste in transfer pipes.

Florida International University (FY 2000 funding $5,000,000) is initiating a program to improve Robotic decontamination and decommissioning equipment that will be used in highly radioactive environments.

Robotics University Program (FY 2000 funding $4,000,000) is supporting deactivation and decommissioning efforts for mapping of facilities and the remote handling of materials.

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
Idaho Technology Validation and Verification Program	14,500	13,500	22,500

The capabilities of the Idaho National Engineering and Environmental Laboratory will be utilized to support and enhance application and deployment of innovative cleanup and waste management technologies across the DOE complex through technology validation and verification and systems engineering activities.

Validation and Verification (FY 2000 funding $14,500,000). Technology validation and verification activities will be used to support and enhance application and deployment of EM innovative and alternative technologies across the DOE complex and to provide a solid technical base for EM cleanup, reduce costs, and leverage the DOE investment into broader national priorities.

Systems Engineering (FY 2000 funding $8,000,000). Systems engineering activities will be used to refine baselines for EM waste management, spent nuclear fuel, and nuclear materials disposition and identify new opportunities to accomplish more efficient and cost effective cleanup and closure of DOE sites. An EM integration activity is conducted utilizing multi-site teams to develop, evaluate, and recommend alternatives to existing baselines for waste management, spent nuclear fuel, and nuclear materials disposition.

	(dollars in thousands)		
	FY 1998	FY 1999	FY 2000
Western Environmental Technology Office	13,393	13,000	10,504

For more than two decades, DOE has used the Western Environmental Technology Office as a test facility, where MSE Technology Applications, Inc., engaged in the research, testing, demonstration, development and application of innovative technologies. In FY 1996, agreements were reached to privatize the Western Environmental Technology Office facility with a 5-year contract through 2001. Privatization will fulfill DOE's financial and management obligations and reduce the Government's costs in contracting services. Under this contract, MSE Technology Applications, Inc. focuses on meeting the high priority technology needs associated with the Mixed Waste Characterization, Treatment and Disposal Focus Area and the Subsurface Contaminants Focus Area. In addition, to support these Focus Areas, MSE works as a demonstration, testing and evaluation center for sponsored technology systems and has the capability to perform life cycle systems engineering analyses on innovative technology systems to maximize the chances of successful implementation and deployment of these technology systems..

Controlled Emissions Demonstration (FY 2000 funding $3,500,000) By 2002, the four operational DOE hazardous waste thermal treatment units must be able to meet the Environmental Protection Agency Maximum Achievable Control Technology Rule or be shutdown. The Maximum Achievable Control Technology Rule states that a compliance plan must be submitted to the Environmental Protection Agency for covered operations within 180 days of promulgation of the rule (January 1999). Noncompliance with the Maximum Achievable Control Technology Rule will threaten DOE's ability to meet compliance agreements. Promising, technologically mature off gas monitoring and treatment systems, which are being tested for organic and inorganic hazardous air pollutants, should address this challenge of emission compliance by 2002.

Subsurface Contaminant and In Situ Remediation (FY 2000 funding $4,300,000) Activities will support the Subsurface Contaminants Focus Area in addressing the problems/needs identified in the following areas: Subsurface Barrier Systems, Vadose Zone Stabilization, In Situ Passive Treatment, Deep Access and Delivery Methods, Containment/Stabilization Verification and Monitoring. This investment directly supports the Subsurface Contaminants Focus Area in their efforts to help meet all 10 Operation Offices requirements, schedules and "Accelerating Cleanup: Paths to Closure" plan goals while directly contributing to cost reduction, schedule compression and risk minimization.

Engineering Analysis (FY 2000 funding $2,704,000) Technical assistance and life cycle systems analysis are critically important to achieving the successful deployment of treatment, remediation, and containment technology systems. These activities will focus on the analysis of technology systems which are ready candidates for implementation and deployment, and on matching newly developed technologies with DOE urgent clean up needs to enhance deployment opportunities and on providing technical assistance to developers and users to assure successful deployment.

	(dollars in thousands)		
	FY 1998	FY 1999	FY 2000
Technology Acceptance and Support	12,822	17,522	14,900

The Technology Acceptance and Support program stimulates wider acceptance of emerging technologies through program and technical peer reviews of technologies, site needs/technology linkage identification and deployment assistance, and longer-term regulatory initiatives. In addition, this activity provides sound business assistance and overall program analysis as well as information dissemination services and linkages to the international scientific community.

Program Information, Review, and Analysis (FY 2000 funding $6,050,000) provides assistance for the Office of Science and Technology business practices, such as preparation of execution guidance and analysis of cost and schedule variances through the DOE Center for Acquisition and Business Excellence. Office of Science and Technology alignments with site needs are collected and provided to the overall EM *Accelerating Cleanup: Paths to Closure* data collection and analysis activity. Independent external peer review processes and program reviews enhance acceptability of key Focus Area decisions and data. Program information and communication provides the Office of Science and Technology with the ability to collect, maintain, analyze, and disseminate key information. Cost savings and benefit analyses highlight potential and actual *Accelerating Cleanup: Paths to Closure* mortgage reductions.

Regulatory and Site Acceptance (FY 2000 funding $6,550,000) contributes to overall Environmental Management mortgage reduction by helping states establish acceptance verification protocols and reciprocity guidelines to expedite multi-state permitting and multi-site deployment. Site acceptance is facilitated by identifying site needs to the Focus Areas as early as possible to ensure the Focus Areas are working on the right problems. Site participation in technology deployment planning and workshops to encourage use of innovative technologies are also included.

International Technology Coordination (FY 2000 funding $600,000) by connecting with international technical capabilities, expands the number of cost-saving innovative technologies available for Environmental Management use through the Focus Areas. Accelerates the EM cleanup by leveraging international science and technology opportunities.

Safety Testing (FY 2000 funding $1,700,000) reduces costs of cleanup by expediting the deployment of Environmental Management technologies and improves worker safety and health by providing operational assessments of high impact environmental technologies and recommending safety, efficiency, and productivity enhancements.

	(dollars in thousands)		
	FY 1998	FY 1999	FY 2000
Small Business Innovative Research Program (Technology Development)	0	2,224	2,000

Funding is requested for the Small Business Innovative Research assessment in accordance with Public Law 102-564, which mandates a percentage of all research and development dollars be set aside for

grants to small businesses. Once funding is appropriated, it is transferred to the DOE Office of Science for award and administration of grants to small businesses.

	(dollars in thousands)		
	FY 1998	FY 1999	FY 2000
Environmental Management Science Program	46,110	47,000 [a]	32,000 [a]

The EM Science Program was created to stimulate basic research and technology development for cleanup of the Nation's nuclear weapons complex. The program's objective is to improve the effectiveness of the cleanup effort over the long term. The importance of basic scientific research to the cleanup mission was established in the Secretary of Energy Advisory Board (Galvin) Report: "There is a particular need for long term, basic research in disciplines related to environmental cleanup...Adopting a science-based approach that includes supporting development of technologies and expertise...could lead to both reduced cleanup costs and smaller environmental impacts at existing sites and to the development of a scientific foundation for advances in environmental technologies."

The Science Program represents a partnership between the Office of Science and the EM program. The Office of Science manages the solicitation of proposals and scientific review process. EM ensures that the research is relevant to the Department's cleanup problems. Science projects funded to date focus on critical problems identified through: 1) workshops at Richland, Savannah River, Oak Ridge, and Idaho; 2) a complex-wide needs survey; 3) solicitation of science research needs in support of the *Accelerating Cleanup: Paths to Closure*; and 4) a systems engineering analysis. To date, of the 235 projects selected, 82 focus on science needed to improve remedial action process; 68 focus on finding better ways to treat and destroy high level waste; 32 focus on waste containing a mixture of radioactive and other hazardous materials (mixed waste); 18 focus on better understanding the health and ecological effects associated with environmental cleanup options; 8 address the materials used in weapons production (nuclear materials); 22 projects focus on technical problems with facility deactivation and decommissioning, and the remaining 5 projects focus on spent nuclear fuel stabilization and disposal. This competitive program has been effective in establishing a link between the EM program and the scientific community. Fourteen of DOE's national laboratories and 96 academic institutions, other Federal laboratories and industrial organizations currently participate in the program. FY 1999 is the last year of funding for the first 136 grants awarded by the program, a $115,000,000 investment, and FY 2000 is the last year of funding for the 66 projects funded in FY 1997, a $46,400,000 investment.

[a] Includes Small Business Innovative Research assessment, in the amounts of $1,162,000 and $765,000 in FY 1999 and FY 2000, respectively.

	(dollars in thousands)		
	FY 1998	FY 1999	FY 2000
Environmental Management Risk Policy Program	7,000	9,000	5,000

Risk informed decision making is critical to the success of the EM program. The EM Risk Policy Program provides the analytical framework and technical support necessary for credible, risk-based environmental decisions. The program provides guidance and tools to assist the project managers in collection of the information that will ensure that high risk projects are prioritized and funded and that risk to workers, the public, and the environment decrease over time. This program supports the risk research needed to support aggressive environmental cleanup of the nuclear weapons production legacy while ensuring that the safety and health of the DOE workforce and members of the public, and the protection of the environment are not compromised in the process.

Funding Profile

(dollars in thousands)

	FY 1998	FY 1999	FY 2000	$ Change	% Change
Mixed Waste, Characterization, Treatment, and Disposal Focus Area	38,934	19,990	23,404	3,414	17.1%
Radioactive Tank Waste Remediation Focus Area	52,513	41,676	48,847	7,171	17.2%
Subsurface Contaminants Focus Area	32,870	31,611	35,080	3,469	11.0%
Deactivation and Decommissioning Focus Area	29,466	22,938	17,112	-5,826	-25.4%
Plutonium Stabilization and Disposition Focus Area	0	5,480	4,253	-1,227	-22.4%
University Programs	21,605	19,215	14,900	-4,315	-22.5%
Idaho Technology Validation and Verification Program	14,500	13,500	22,500	9,000	66.7%
Western Environmental Technology Office	13,393	13,000	10,504	-2,496	-19.2%
Technology Acceptance and Support	12,822	17,522	14,900	-2,622	-15.0%
Small Business Innovative Research Program (Technology Development)	0	2,224	2,000	-224	-10.1%
Environmental Management Science Program	46,110 [a]	47,000	32,000	-15,000	-31.9%
Environmental Management Risk Policy Program	7,000	9,000	5,000	-4,000	-44.4%
Total, Science and Technology	269,213 [b]	243,156 [b c]	230,500 [b c]	-12,656	-5.2%

Public Law Authorizations:

Public Law 95-91, Department of Energy Organization Act (1977)

Public Law 105-245, The Energy and Water Development Appropriations Act, Fiscal Year 1999

Public Law 105-261; Strom Thurmond National Defense Authorization Act for Fiscal Year 1999

Public Law 103-62; Government Performance and Results Act of 1993

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[a] Excludes $678,000 for general reduction to FY 1998 Defense EM appropriation.

[b] Includes capital equipment estimates of $3,000,000 for FY 1998, $2,500,000 for FY 1999, and $2,000,000 for FY 2000.

[c] Final distribution of funds by program category in FY 1999 and FY 2000 could change based upon changing priorities, and final receipt, review, selection, and award of technical proposals.

Funding by Site

(dollars in thousands)

	FY 1998	FY 1999	FY 2000	$ Change	% Change
Albuquerque Operations Office					
Allied Chemical (MO)	1,200	167	167	0	>999.9%
Los Alamos National Laboratory (NM)	9,411	6,389	2,253	-4,136	-64.7%
Sandia National Laboratory (NM)	6,263	7,209	1,428	-5,781	-80.2%
Lovelace Biomedical and Environmental Research Institute (CO)	450	122	0	-122	-100.0%
Mid-West Research Institute (CO)	210	221	0	-221	-100.0%
Grand Junction Project Office (CO)	0	0	166	166	>999.9%
Albuquerque Operations Office (NM)	11,400	8,511	6,370	-2,141	-25.2%
Total, Albuquerque Operations Office	28,934	22,619	10,384	-12,235	-54.1%
Chicago Operations Office					
Ames Laboratory (IA)	1,145	1,102	155	-947	-85.9%
Argonne National Laboratory (West) (ID)	6,353	3,428	535	-2,893	-84.4%
Brookhaven National Laboratory (NY)	2,530	1,189	822	-367	-30.9%
Chicago Operations Office (IL)	5,509	5,842	3,040	-2,802	-48.0%
Total, Chicago Operations Office	15,537	11,561	4,552	-7,009	-60.6%
Idaho Operations Office					
Idaho National Engineering and Environmental Laboratory (ID)	26,029	28,587	32,888	4,301	15.0%
Idaho Operations Office (ID)	20,957	21,121	47,837	26,716	126.5%
Total, Idaho Operations Office	46,986	49,708	80,725	31,017	62.4%
Federal Energy Technology Center (FETC)					
West Virginia	60,245	42,237	37,799	-4,438	-10.5%
Pennsylvania	12,643	13,000	10,504	-2,496	-19.2%
Total, Federal Energy Technology Center (FETC)	72,888	55,237	48,303	-6,934	-12.6%
Nevada Operations Office					
Nevada Operations Office (NV)	2,713	2,765	2,621	-144	-5.2%
Oak Ridge Operations Office					
Oak Ridge Inst. For Science and Education (TN)	508	170	0	-170	-100.0%
Oak Ridge Operations Office (TN)	28,588	26,490	17,039	-9,451	-35.7%
Total, Oak Ridge Operations Office	29,096	26,660	17,039	-9,621	-36.1%
Oakland Operations Office					
Lawrence Berkeley National Laboratory (CA)	3,962	3,455	700	-2,755	-79.7%
Lawrence Livermore National Laboratory (CA)	4,192	3,540	0	-3,540	-100.0%
Oakland Operations Office (CA)	240	1,672	2,477	805	48.1%
Total, Oakland Operations Office	8,394	8,667	3,177	-5,490	-63.3%

(dollars in thousands)

	FY 1998	FY 1999	FY 2000	$ Change	% Change
Ohio Operations Office					
Fernald Environmental Management Project (OH)	2,851	990	1,567	577	58.3%
Mound (OH)	2,336	0	645	645	>999.9%
Ohio Operations Office (OH)	590	6,385	3,920	-2,465	-38.6%
Total, Ohio Operations Office	5,777	7,375	6,132	-1,243	-16.9%
Richland Operations Office					
Pacific Northwest National Laboratory (WA)	20,918	14,696	10,322	-4,374	-29.8%
Richland Operations Office (WA)	12,554	11,956	2,541	-9,415	-78.7%
Total, Richland Operations Office	33,472	26,652	12,863	-13,789	-51.7%
Rocky Flats Office					
Kaiser Hill (CO)	750	2,925	2,800	-125	-4.3%
Rocky Flats Office (CO)	3,220	900	430	-470	-52.2%
Total, Rocky Flats Office	3,970	3,825	3,230	-595	-15.6%
Savannah River Operations Office					
Savannah River Site (SC)	8,421	10,966	22,339	11,373	103.7%
Savannah River Operations Office (SC)	1,650	3,835	9,142	5,307	138.4%
Total, Savannah River Operations Office	10,071	14,801	31,481	16,680	112.7%
Headquarters					
Washington, D.C.	11,375	13,286	9,993	-3,293	-24.8%
Total, Science and Technology	269,213 [d]	243,156 [e]	230,500 [b]	-12,656	-5.2%

[d] Excludes $678,000 for general reduction to FY 1998 Defense EM appropriation.

[e] Final distribution of funds by field office in FY 1999 and FY 2000 could change based upon changing priorities, and final receipt, review, selection and award of technical proposals.

Mixed Waste, Characterization, Treatment and Disposal Focus Area

Mission Supporting Goals and Objectives

Program Mission

The mission of the Mixed Waste Characterization, Treatment and Disposal Focus Area is to provide technical capabilities and deployment assistance, in partnership with other Environmental Management programs, to provide fully integrated, technically defensible solutions for cleanup and long term stewardship of mixed hazardous and radioactive wastes at DOE sites.

Program Goal

The goal of the Mixed Waste Characterization, Treatment and Disposal Focus Area is to provide technical and engineering solutions for supporting effective, efficient mixed waste treatment technology systems. Site Treatment Plans identified 165,000 m^3 of mixed waste in storage that includes over 2,300 mixed waste streams at 36 sites. In addition, an estimated 181,000 m^3 of mixed low-level waste and transuranic waste will be generated over the next five years.

Program Objectives

The objective of the Mixed Waste Characterization, Treatment and Disposal Focus Area is to develop technologies that address the mixed-low-level and mixed transuranic waste needs identified by the Site Technology Coordination Groups and that have been incorporated in the Department's *Accelerating Cleanup: Paths to Closure* strategy. Having developed and assessed several primary mixed waste treatment systems, the current Mixed Waste Characterization, Treatment and Disposal Focus Area strategy emphasizes development and deployment of enabling technologies to assist the Department in meeting its mixed waste schedule commitments to regulators and the public at 40 sites in 19 states. With the funding provided, this Focus Area will assist in the deployment of alternative technologies at individual sites and implement and maintain sound program management and integration processes.

Performance Measures

The Science and Technology FY 2000 corporate performance metrics (30 technologies or technology systems demonstrated; 30 technologies or technology systems made available for implementation; 60 alternative technologies deployed) are set at the Project Baseline Summary level, based on past program performance and budget requested. The complete listing of specific technologies, by Focus Area, that will be demonstrated, made ready for implementation or deployed is made available after final FY 2000 project level funding is known and FY 2000 annual performance plans are finalized by each Focus Area. FY 2000 annual performance plans are schedule to be finalized by September 30, 1999.

Significant Accomplishments and Program Shifts

- Complete, in FY 1999, development and demonstration of alternatives to open flame combustion high temperature (i.e., incineration). These technologies support facility compliance at 6 States and can address approximately 5,400 m^3 of mixed low-level and transuranic waste.
- Complete, in FY 2000, deployment of the neutron interrogation technology for the assay of waste containers at Los Alamos National Laboratory, Rocky Flats, Oak Ridge, and Idaho. This process minimizes risks to workers since it reduced the number of drums that must be manually opened for analysis and enables certification of a significant number of drums that cannot be certified by any other technique.
- Deploy, in FY 2000, hydrogen gas getters to reduce flammable gas concentrations in drums of waste being shipped to the Waste Isolation Pilot Plant. This will allow large amounts of waste to be contained in each drum.
- Demonstrate, in FY 2000, assay capabilities for remotely handled waste and demonstrate screening methods for segregation of large quantities into transuranic versus low-level waste.
- Demonstrate at Savannah River, in FY 2000, the capability to remotely segregate transuranic waste from low-level waste.
- At the end of FY 1999, thermal treatment systems (i.e., incineration) and mercury contamination activities will be discontinued and program emphasis will shift to non-thermal treatment solutions and characterization and handling technology needs of transuranic waste for shipment to the Waste Isolation Pilot Plant.

Funding Schedule

(dollars in thousands)

	FY 1998	FY 1999	FY 2000	$ Change	% Change
Material Handling and Characterization Solutions	16,007	11,852	18,209	6,357	53.6%
Non-Thermal Treatment Solutions	13,538	4,877	5,195	318	6.5%
Thermal Treatment Enabling Solutions	9,389	3,261	0	-3,261	-100.0%
Total, Mixed Waste, Characterization, Treatment and Disposal Focus Area	38,934	19,990	23,404	3,414	17.1%

Detailed Program Justification

(dollars in thousands)

FY 1998	FY 1999	FY 2000

Material Handling and Characterization Solutions

All major sites and laboratories that will ship transuranic waste to the Waste Isolation Pilot Plant have identified technology needs in preparing waste for shipment and disposal. While current technologies focus primarily on enabling the successful management of low activity, contact handled transuranic wastes in 55-gallon drums, a large portion of the waste consists of categories for which assay, handling and transportation is not currently available. Solutions for improving the end-users' capability to non-destructively examine containerized waste and assay the contents to distinguish between radioactive and hazardous constituents will be developed and deployed. The need for non-destructive analysis technology is especially critical for remote handled waste types and to facilitate the segregation of transuranic waste from low-level waste. A reduction of costs can be achieved through non-destructive analysis of wastes to be treated at the three incinerators operated by DOE at Oak Ridge, the Savannah River Site, and Idaho. Activities will also focus on increasing the payload efficiency of transuranic waste shipments to treatment and disposal facilities by addressing hydrogen gas generation and buildup and improving the end-users' capability to remotely handle highly radioactive waste streams during sizing, repackaging and transport operations. Hydrogen gas generation and build-up due to radiolysis of hydrogenous waste materials and subsequent potential flammability/explosion concerns during transport, limit the amount of contact handled and remote handled transuranic waste that can be shipped using the TRUPACT-II and 72B casks. Also, because of the hazard associated with these wastes, advanced remote handling systems are needed to improve safety and efficiency of operations. All activities relating to identification, development and assessment of technologies will be closely coordinated with the National Transuranic Waste Management Program at the Department of Energy Carlsbad Area Office.

(dollars in thousands)

FY 1998	FY 1999	FY 2000

The proposed Maximum Achievable Control Technology standard will require a detailed characterization of all waste prior to it being treated in a thermal treatment unit. At the present time, there is no effective method to provide the required characterization. Improved radionuclide non-destructive analysis characterization methods are needed to support elimination of waste from small quantity sites such as Mound and Battelle Columbus.

In FY 2000, there are three distinct work elements which support this product line: 1.) Non-destructive Characterization for Treatment, Transportation and Disposal of Mixed Low-Level/Mixed Transuranic Waste; 2.) Payload Enhancement for Transportation of Transuranic Waste within Regulatory Limits; and 3.) Handling Mixed Waste Contaminants Materials during Characterization, Treatment, Packaging and Disposal.

- # Continue algorithm and hardware development and deployment of improved assay technology systems for boxed wastes. Activities include hardware/algorithm improvements to systems identified through FY 1998 and FY 1999 demonstrations/evaluations.
- # Complete the deployment of the neutron interrogation technology for the assay of the Resource Conservation and Recovery Act metal in waste containers.
- # Develop and demonstrate solutions to meet Waste Isolation Pilot Plant remote handled waste assay requirements. Technology development will focus on demonstration of remote handled waste assay capabilities on real waste streams; implementation of improved assay components in remote handled waste characterization systems; development of mobile non-destructive analysis capability based on demonstrated methods; and demonstration of screening methods to support segregation of large components into transuranic versus low-level waste.
- # Evaluate and deploy technologies, such as, improved Hydrogen getters, filters, and alternative packaging materials to minimize impact of hydrogen gas on transportation.

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
# Evaluate effects of gamma radiation on hydrogen gas generation.			
# Deploy automated transuranic waste sorting system at the Savannah River Site to verify and prepare drummed waste for transfer to Waste Isolation Pilot Plant. This system will open drums, gain access to contents, remove non-compliant items and repackage waste to meet Waste Isolation Pilot Plant acceptance criteria.			
# Adapt the Savannah River Site automated waste sorting system to a mobile format for use at Mound and Battelle Columbus sites to prepare waste for transfer to Waste Isolation Pilot Plant.			
# Develop robust sizing technology for use at Richland to allow segregation of large transuranic and low-level waste to reduce final volume of wastes transferred to Waste Isolation Pilot Plant.			
# Complete automated contaminant analysis process for metals and organics.			
Material Handling and Characterization Solutions	16,007	11,852	18,209

Non-Thermal Treatment Solutions

Regulatory and public concerns have resulted in specific instances where alternatives to incineration must be used for treatment of mixed waste prior to disposal. Stakeholders are highly supportive of alternatives to open flame treatment systems because of reduced secondary waste generation. Although the number of potential waste streams amenable to this type of treatment is limited, these technologies, in certain instances, provide preferable treatment alternatives. Demonstrations will provide performance data on guidelines for selection of the most appropriate technology for treatment of a given waste. Activities developing and deploying solutions for destroying organics in waste using non-flame alternatives to incineration will primarily focus on Alternative Oxidation Technologies. These processes are needed to treat difficult, DOE tri-mixed waste streams, including mixtures of transuranic, polychlorinated biphenyl, tritium, actinides, mercury, or problematic hazardous chemical contaminants.

	(dollars in thousands)		
	FY 1998	FY 1999	FY 2000
In FY 2000, there is one work element which support this Product Line: 1.) Alternatives to Incineration to Reduce Emission Hazards.			
# Issue an Alternative Oxidation Technology Request for Proposal to the private sector to demonstrate treatment of the Savannah River Site Plutonium-238 contaminated waste, such as clothing, rags and packaging.			
# Issue an Alternative Oxidation Technology Request for Proposal to the private sector for a process to treat polychlorinated biphenyl contaminated mixed waste.			
# Demonstrate a tritiated waste treatment technology.			
# Deploy stabilization and volume reduction technologies at Oak Ridge, Rocky Flats, and Idaho.			
Non-Thermal Treatment Solutions	13,538	4,877	5,195
Thermal Treatment Enabling Solutions			
Activities include developing and deploying solutions for improving the off gas control and monitoring of the Department's waste incinerators to meet the proposed Maximum Achievable Control Technology Rule limits. If cost effective alternatives for the Maximum Achievable Control Technology compliance are not available for the DOE's three incinerators, located at Idaho, Savannah River and Oak Ridge, and Idaho's high-level liquid waste calciner, they may be forced to shut down in FY 2001. This will impact the ability of these sites to meet compliance agreements. Specific problem areas include mercury and dioxins and furans. The development of control and monitoring solutions for these off gas treatment systems must be proven effective to make these technologies more widely applicable.			
# This activity will not be continued into FY 2000.			
Thermal Treatment Enabling Solutions	9,389	3,261	0
Total, Mixed Waste, Characterization, Treatment and Disposal Focus Area	38,934	19,990	23,404

Explanation of Funding Changes from FY 1999 to FY 2000

	FY 2000 vs FY 1999 ($000)
Material Handling and Characterization Solutions	
# Increase supports focus on developing, demonstrating and deploying technologies that address technology needs for characterizing and handling transuranic waste for shipment to the Waste Isolation Pilot Plant	6,357
Non-Thermal Treatment Solutions	
# Increase supports efforts to develop, demonstrate and deploy technologies, primarily Alternative Oxidation Technologies, which offer non-flame alternatives to incineration of organics in waste	1,028
# Technology development activities related to stabilization of salt and ash waste will be completed in FY 1999 and mercury contamination technology development will not be continued in FY 2000	-710
Thermal Treatment Enabling Solutions	
# Thermal Treatment (i.e., incineration) activities will be discontinued in FY 2000	-3,261
Total Funding Change, Mixed Waste, Characterization, Treatment and Disposal Focus Area	3,414

Radioactive Tank Waste Remediation Focus Area

Mission Supporting Goals, and Objectives

Program Mission

The mission of the Radioactive Tank Waste Remediation Focus Area is to provide technical capabilities and deployment assistance, in partnership with other Environmental Management programs, to provide fully integrated technically defensible solutions for cleanup and long term stewardship of radioactive tank waste at DOE sites.

Program Goal

There are 271 large radioactive waste storage tanks and more than 63 miscellaneous underground storage tanks across the DOE complex containing over 90 million gallons of radioactive waste. Most of these tanks have exceeded their design life and represent significant occupational and public risks. Current site baseline technologies are costly, pose significant programmatic and safety risks, and have technology gaps. The goal of the Radioactive Tank Waste Remediation Focus Area is to systematically manage the development and facilitate the deployment of technologies using an integrated approach to safely and efficiently achieve tank waste remediation across the DOE complex in support of the *Accelerating Cleanup: Paths to Closure*. Accomplishment of this goal will support closure of tank farms complex-wide while minimizing life-cycle costs.

Program Objectives

The objective of this Focus Area is to address the technical needs identified for management of high-level waste and closure of tanks by the Site Technology Coordination Groups which have been incorporated in the Department's *Accelerating Cleanup: Paths to Closure* strategy. The Tank Waste Remediation Focus Area activities have progressed from early-stage technology development to advanced, fully deployable systems. This work is being accomplished in close partnership with users and with continual participation of tribal governments, regulators, and stakeholders. Within the funding provided, this Focus Area will assist in the deployment of alternative technologies at individual sites and implement and maintain sound program management and integration processes.

Performance Measures

The Science and Technology FY 2000 corporate performance metrics (30 technologies or technology systems demonstrated; 30 technologies or technology systems made available for implementation; 60 alternative technologies deployed) are set at the Project Baseline Summary level, based on past program performance and budget requested. The complete listing of specific technologies, by Focus Area, that will be demonstrated, made ready for implementation or deployed, is made available after final FY 2000 project funding level is known and FY 2000 annual performance plans are finalized by each Focus Area. FY 2000 annual performance plans are scheduled to be finalized by September 30, 1999.

Significant Accomplishments and Program Shifts

- Deploy, in FY 2000, saltcake dissolution and sludge heel (hardened waste at the bottom of tanks) retrieval technologies to enable closure of the Savannah River Site and Hanford high-level waste tanks. Current methods require the introduction of large amounts of water to re-dissolve or suspend wastes in a solution.
- Deploy, in FY 2000, robotic/remote technologies to permanently seal, from the inside, the openings of Gunite and associated tanks at Oak Ridge from pipes that were once used to deliver radioactive waste to the tanks. Capping from the outside has not prevented rain water from leaking into the tanks.
- Demonstrate and deploy, in FY 2000, tank inspection technologies to ensure tank integrity at Idaho, Oak Ridge, Hanford, and Savannah River.
- Demonstrate and deploy, in FY 2000, caustic recycle and recovery technologies that reduce the volume of low level waste streams returning to the Defense Waste Processing Facility Storage Tanks to avoid construction of an additional grout vault at Savannah River.
- Beginning in FY 2000, program emphasis will increase on pretreatment, immobilization and volume reduction technology development to enable high-level waste tank closures across the DOE complex.

Funding Schedule

(dollars in thousands)

	FY 1998	FY 1999	FY 2000	$ Change	% Change
Tank Waste Retrieval and Closure	27,529	22,552	19,744	-2,808	-12.5%
Tank Waste Pretreatment and Immobilization	24,984	19,124	29,103	9,979	52.2%
Total, Radioactive Tank Waste Remediation Focus Area	52,513	41,676	48,847	7,171	17.2%

Detailed Program Justification

(dollars in thousands)

FY 1998	FY 1999	FY 2000

Tank Waste Retrieval and Closure

Hanford and the Savannah River Site must maintain and ensure tank integrity as tanks will be used for storage up to 30 more years to meet accelerated cleanup goals and tank integrity inspections must occur at Hanford, Savannah River, Idaho, and Oak Ridge prior to initiating waste retrieval operations leading to closure. In order to facilitate the closure of tanks at the Savannah River Site and Hanford technologies need to be developed that will remove sludge and saltcake at rates to support waste processing. Oak Ridge must close tanks to meet Comprehensive Environmental Response, Compensation, and Liability Act requirements for the gunite and associated tanks.

In FY 2000, there is one work element which supports this Product Line: 1.) Technology Development to Support Tank Closure.

- Deploy saltcake dissolution and sludge heel retrieval technologies to remove waste and allow closure of the Savannah River Site and Hanford high-level waste tanks that are not potential leakers.
- Deploy robotic/remote operational retrieval technologies for hard-to-access tanks at Oak Ridge (functional flow analysis tanks) and the Savannah River Site (solvent extraction tanks).
- Deploy robotic/remote technologies for isolating, stabilizing, and closing Gunite and associated tanks at Oak Ridge.
- Deploy technologies for maintaining safe storage conditions by monitoring corrosion in tanks at Hanford and the Savannah River Site.
- Demonstrate and deploy tank inspection technologies to ensure tank integrity before waste retrieval and tank closure at Idaho, Oak Ridge, Hanford, and Savannah River Site.
- Continue Hanford Tanks Initiative activities at a reduced level.

Tank Waste Retrieval and Closure	27,529	22,552	19,744

(dollars in thousands)

FY 1998	FY 1999	FY 2000

Tank Waste Pretreatment and Immobilization

The Savannah River Site, Hanford, and Idaho require improved baseline treatment process development and improvement to meet their regulatory schedules. Savannah River must maintain Defense Waste Processing Facility operations and improve throughput to meet canister production requirements; Hanford must prepare for, and deliver feed for privatization Phase 1, accept immobilized product from the private vendor, and develop the baseline data to support privatization Phase 2 procurement package; Idaho must continue baseline flowsheet development and testing to meet Title 1 design schedule. Sludge transfer at Oak Ridge Melton Valley Storage Tanks must be accomplished to meet privatization schedules.

Specific activities for Savannah River will develop and test next generation melter designs and process control methods to enhance Defense Waste Processing Facility throughput, reduce operating costs, and eliminate melter pour spout problems; demonstrate and implement integrated processes for the Defense Waste Processing Facility to support continued sludge-only feed, and reduce the volume of high-level waste canisters produced; and support development and testing of a new chlorinated solvents removal flowsheet for Savannah River to replace in-tank precipitation. In-Tank Precipitation shutdown at Savannah River severely impacts the ability of the site to maintain Defense Waste Processing Facility operations to meet regulatory requirements and *Accelerating Cleanup: Paths to Closure* goals. Caustic recycle and sodium recovery technologies will be developed to reduce the volume of low-level waste and avoid construction of an additional grout vault at Savannah River.

For Hanford, methods and standards will be developed and tested for low-level and high-level immobilized waste product acceptance for Hanford Phase 1 and 2 to minimize risk of accepting waste from privatization contractors that is not adequately processed; and delivery of a privatization-feed sampling and analysis system to ensure Phase 1 feed delivery meets contract requirements; develop and test baseline sludge and leachate processing to ensure adequate feed delivery and avoid conditions that may cause unwanted solids formation that would deploy feed delivery to privatization vendors.

(dollars in thousands)

FY 1998	FY 1999	FY 2000

Support to the Idaho National Engineering and Environmental Laboratory will provide technical data required to define the integrated flowsheet for Title 1 design including dissolution of calcine, transuranic waste, cesium, and strontium removal, and low-activity waste and high-activity waste immobilization to enable discontinuation and retrieval of all tank farm wastes to meet the Governor's agreement (Batt Agreement).

Technical solutions delivered through the completion of these activities will: help optimize melter design and operation, and ensure quality low-level and high-level waste products at Hanford, Oak Ridge, Idaho, and Savannah River; help provide alternative solutions to the In-Tank Precipitation process for treatment of high-level at Savannah River, enable treatment of newly generated waste streams that are adding to existing tank waste volumes at Savannah River, Idaho, and Oak Ridge; provide the technical data required to enable operations that separate solids and liquids prior to pretreatment and vitrification of sludges at Savannah River and enable Privatization success at Oak Ridge, and Hanford; and help reduce the volume of high-level and low-level waste forms at Savannah River, Idaho, Hanford, and Oak Ridge.

In FY 2000, there are four distinct work elements which support this Product Line: 1.) High Level Waste Immobilization and Product Acceptance; 2.) Alternative Paths to Salt Waste Treatment; 3.) Pretreatment to Reduce Volume of High-Level Waste and Low-Level Waste Forms; and 4.) Slurry Preparation for Feed to High-Level Waste Vitrification.

- # Provide data bases, standards, and tests to meet waste analytical glass standards and provide a basis for long-term performance.
- # Provide data for design of second generation pour spout and melter to optimize waste throughput.
- # Optimize glass formulation to improve waste loading of radionuclides, thereby minimizing glass generation.
- # Support and test a new cesium-removal flowsheet for Savannah River site to replace In-Tank Precipitation.

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
# Demonstrate settle-decant process to separate solids and liquids as a first step in sludge processing at Savannah River and Hanford.			
# Demonstrate feed delivery systems including variable depth sampling, automated in-line laser ablation/mass spectroscopy, and sludge monitors at Hanford.			
# Deploy cross-flow filtration at Oak Ridge.			
# Provide technical data required for the Defense Waste Processing Facility operations with sludge at Savannah River and for Hanford Phase 2 privatization sludge treatment to reduce the high-level waste production.			
# Support development of integrated process for acidic tank waste treatment required to meet Batt Agreement.			
# Demonstrate and deploy caustic recycle and recovery to reduce the volume of low-level waste streams and avoid construction of an additional grout vault at Savannah River.			
Tank Waste Pretreatment and Immobilization	24,984	19,124	29,103
Total, Radioactive Tank Waste Remediation Focus Area	52,513	41,676	48,847

Explanation of Funding Changes from FY 1999 to FY 2000

	FY 2000 vs FY 1999 ($000)
Tank Waste Retrieval and Closure	
# Decrease reflects reduced level of effort for Hanford Tanks Initiative (-$4,000), offset by an increase to support activities to develop, demonstrate and deploy retrieval technologies to facilitate closure of tanks at Savannah River and Oak Ridge; robotic/remote technologies for isolating, stabilizing and closing tanks at Oak Ridge; tank inspection technologies to ensure tank integrity of tanks at Idaho, Oak Ridge, Hanford and Savannah River (+$1,192)	-2,808
Tank Waste Pretreatment and Immobilization	

	FY 2000 vs FY 1999 ($000)
# Increase supports activities to develop, demonstrate and deploy technologies to: reduce volumes of high-level and low-level waste forms at Savannah River, Idaho, Hanford and Oak Ridge; provide alternative solutions to the In-Tank Precipitation process for treatment of high-level at Savannah River; enable treatment of newly generated waste streams that are adding to existing tank waste volumes at Savannah River, Idaho and Oak Ridge; and technical data to enable separation and vitrification of waste at Savannah River and enable Privatization success at Oak Ridge and Hanford	9,979
Total Funding Change, Radioactive Tank Waste Remediation Focus Area	7,171

Subsurface Contaminants Focus Area

Mission Supporting Goals, and Objectives

Program Mission

The mission of the Subsurface Contaminants Focus Area is to provide technical capabilities and deployment assistance, in partnership with other Environmental Management programs, to provide fully integrated, technically defensible solutions for cleanup and long term stewardship of soils and groundwater at DOE sites.

Program Goal

The goal of the Subsurface Contaminants Focus Area's mission is to develop, demonstrate, and facilitate the deployment of innovative technologies that accomplish characterization, monitoring, containment, and long-term isolation of buried waste areas and achieve in situ remediation of dispersed contaminants while reducing cost of remediation, and risk to health and safety, meeting regulatory compliance requirements, and enabling technical solutions where none presently exist.

Across the DOE complex, 5,700 plumes contaminate more than 75 million m^3 of soil and 475 billion gallons of ground water with volatile organic compounds, Dense Non-Aqueous Phase Liquids, hazardous metals and radionuclides. There is an additional 3 million m^3 of solid radioactive and hazardous wastes buried in landfills, trenches, and spill areas. The contaminants pose significant health and safety risks and are present at all DOE sites, located at various depths in the vadose and saturated zones. In order to meet the *Accelerating Cleanup: Paths to Closure* goals and Federal and state compliance laws, cleanup must be accelerated and cleanup costs reduced. The Subsurface Contaminants Focus Area is coordinating vadose zone research efforts with all DOE operations offices, especially Richland in their efforts for remediation of contaminants under the high level waste tanks.

Program Objectives

The objective of this Focus Area is to develop technologies that address environmental restoration problem area needs identified by the Site Technology Coordination Groups and have been incorporated in the Department's *Accelerating Cleanup: Paths to Closure* strategy. Implementation of this program in an integrated manner with other Federal agencies, industry, national labs, and universities will result in faster cleanup and lower cost to the taxpayer. With the funding provided, this Focus Area will assist in the deployment of alternative technologies at individual sites and implement and maintain sound program management and integration processes.

Performance Measures

The Science and Technology FY 2000 corporate performance metrics (30 technologies or technology systems demonstrated; 30 technologies or technology systems made available for implementation; 60 alternative technologies deployed) are set at the Project Baseline Summary level, based on past program performance and budget requested. The complete listing of specific technologies, by Focus Area, that will be demonstrated, made ready for implementation or deployed, is made available after final FY 2000 project level funding is known and FY 2000 annual performance plans are finalized by each Focus Area. FY 2000 annual performance plans are scheduled to be finalized by September 30, 1999.

Significant Accomplishments and Program Shifts

- In FY 1999 and FY 2000, increased program emphasis will be on addressing characterization and delineation of Dense Non-Aqueous Phase Liquids in the vadose zone, saturated zone and deep, complex geologic settings.
- Continue, in FY 1999, multi-years tasks performed in cooperation with the Environmental Protection Agency to improve landfill caps, covers and barriers to prevent the migration of wastes from DOE sites. The Environmental Protection Agency will incorporate the data from these successful demonstrations into national landfill cover design guidance.
- Deploy, in FY 2000, seismic reflection technology at Savannah River to enable non-invasive location/distribution of free phase Dense Non-Aqueous Phase Liquids.
- Deploy, in FY 2000, in situ vadose zone chemical treatment technologies at Paducah, Kentucky and Portsmouth, Ohio, Nevada Test Site, and Richland.
- Complete, in FY 2000, Phase II multi-Federal agency demonstration for the removal of Dense Non-Aqueous Phase Liquids contamination from soil at Cape Canaveral using heating technologies and surfactant flushing.
- Deploy, in FY 2000, containment and cover systems in support of Richland vadose zone integration and Columbia River protection efforts.
- Complete, in FY 2000, deployment of advanced landfill cover at the Nevada Test Site.

Funding Schedule

(dollars in thousands)

	FY 1998	FY 1999	FY 2000	$ Change	% Change
Dense Non-Aqueous Phase Liquids	12,722	15,002	18,829	3,827	25.5%
Source Term Containment/Source Term Remediation	9,778	6,604	5,372	-1,232	-18.7%
Metals and Radionuclides in the Vadose and Saturated Zones	10,370	10,005	10,879	874	8.7%

Total, Subsurface Contaminants Focus Area	32,870	31,611	35,080	3,469	11.0%

Detailed Program Justification

(dollars in thousands)

FY 1998	FY 1999	FY 2000

Dense Non-Aqueous Phase Liquids (Delineation, Removal or In Situ Treatment)

All major DOE sites have groundwater contamination resulting from the discharge into the soil of difficult to remediate, toxic and carcinogenic solvents termed Dense Non-Aqueous Phase Liquids. Dense Non-Aqueous Phase Liquids are difficult to locate, and even in small quantities, create large contaminated groundwater plumes. The dense nature and low solubility of these compounds allows them to move downward through the vadose zone and groundwater and to spread laterally along low permeability layers forming disseminated pools, which slowly contaminate groundwater. No capability exists to cost effectively locate Dense Non-Aqueous Phase Liquids sources; therefore, pump-and-treat, or other costly and ineffective treatment systems must be used to maintain compliance and to carry out a minimal and time consuming cleanup. In some hydrogeologic settings, it is not practical to install pumping systems. Focus will be on the development of technologies and methods to locate and quantify Dense Non-Aqueous Phase Liquids sources, treat the contaminated groundwater and soils in situ to reduce cleanup mortgages while enabling cost effective cleanup. Virtually every field office site across the complex has need for improved analytical tools and in situ monitoring devices that eliminate the need to retrieve and transport samples. Dense Non-Aqueous Phase Liquid activities, including innovative characterization technologies, reactive barrier technologies, bioremediation, and in situ chemical destruction will be demonstrated in cooperation with other Federal agencies and in international initiatives. Significant efforts by private industry and the DOE National Laboratories will be aimed at contaminant characterization and delineation in the vadose zone and deep and complex geologic settings.

(dollars in thousands)

FY 1998	FY 1999	FY 2000

In FY 2000, there are six distinct work elements which support this Product Line: 1.) Vadose and Saturated Zone Characterization, Monitoring, Modeling and Analysis; 2.) In Situ Passive and Reactive Systems; 3.) Advanced Bioremediation and Enhanced Natural Attenuation; 4.) Vadose Zone Chemical Treatment Targeted for Dense Non-Aqueous Phase Liquids; 5.) Saturated Zone Chemical Treatment Targeted for Dense Non-Aqueous Phase Liquids; 6.) Deep Subsurface Access and Placement for Dense Non-Aqueous Phase Liquids.

- # Deploy Seismic Reflection technology at Savannah River for non-invasive location and characterization of free phase Dense Non-Aqueous Phase Liquids.
- # Demonstrate Dense Non-Aqueous Phase Liquids location techniques in deep and fractured geologic settings.
- # Continue development of vadose zone contaminant fate and transport models.
- # Deploy Laser Induced Fluorescence, Alcohol Microinjection/Extraction, and Hydrophobic Flexible Membrane at Savannah River.
- # Perform verification of Dense Non-Aqueous Phase Liquids Reactive Barrier.
- # Deploy Bioremediation Treatment Technology System at the Idaho National Engineering and Environmental Laboratory.
- # Continue development of Phytoremediation technologies with university and international partners.
- # Deploy Electro-osmosis (Lasagna™) technology at Paducah, Kentucky.
- # Deploy hydro fracturing technology to treat Dense Non-Aqueous Phase Liquids in clay at Portsmouth, Ohio.
- # Complete side-by-side demonstration of Dense Non-Aqueous Phase Liquids remediation and characterization technologies with other Federal agencies at Cape Canaveral.
- # Deploy Hydrous Pyrolysis technology at Portsmouth and Savannah River Site 321.
- # Demonstrate In Well Air Stripping, (NOVocs™) at Brookhaven National Laboratory for offsite Dense Non-Aqueous Phase Liquids that have migrated off site.

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
# Continue joint Environmental Protection Agency/Department of Defense/industry effort to demonstrate surfactant technology to enhance aquifer remediation.			
# Assess post-treatment Dense Non-Aqueous Phase Liquids mobility at Savannah River.			
# Deploy deep Dense Non-Aqueous Phase Liquids access and treatment delivery system at Oak Ridge.			
Dense Non-Aqueous Phase Liquid	12,722	15,002	18,829

Source Term Containment/Source Term Remediation

DOE continues to spend a large part of its resources on the monitoring and maintenance of leaking radioactive and mixed waste landfills to achieve compliance with regulatory requirements. In addition, DOE will not be able to remediate these landfills to appropriate standards due to the presence of hazardous materials. Landfill containment systems are currently being deployed across the DOE complex and nation. However, many of these cover systems which were built to current regulatory specifications are failing and will require costly repair or replacement. The development of improved verification and monitoring systems to evaluate both the construction and performance of barrier systems will improve barrier performance and reduce the life-cycle cost of containment. Currently, verification and monitoring systems exist only for newly constructed engineered landfills. Additionally, the emplacement of barriers at significant depths has not been accomplished. Current remediation actions do not utilize deep-placement technologies, often selecting more costly solutions. The demonstration of deep-placement barriers will improve alternatives and reduce costs. In addition, source term retrieval of DOE mixed waste has not been done. Therefore, better caps, covers and barriers are needed to prevent the migration of the unique DOE disposed wastes.

(dollars in thousands)

FY 1998	FY 1999	FY 2000

A design manual for a risk based design life is required. Technologies also need to be developed to stabilize and/or retrieve hot spots with unusually high contamination levels so that they can be appropriately treated or disposed. These solutions will reduce the risk of contaminant migration in the environment, speed cleanup, and facilitate safer cleanup. All this serves to reduce risk to the public and site workers as well as reduce environment degradation.

In FY 2000, there are four distinct work elements which support this Product Line: 1.) Subsurface Barrier Systems in the Vadose Zone; 2.) Stabilization of Contaminants in the Vadose Zone; 3.) Hot Spot Removal from Landfills and Subsurface Sources; and 4.) Waste Containment/Stabilization Verification and Monitoring.

- # Demonstrate subsurface containment systems in support of the Richland vadose zone integration and Columbia River protection efforts at depths greater than 100 feet.
- # Verify performance of in situ vitrification system using innovative bottom up approach at actual waste sites at Los Alamos National Laboratory.
- # Deploy “Dig Face characterization” technology to delineate soil contamination at the Fernald Environmental Management Project.
- # Deploy Segmented Gate Soil Processing technology at Mound.
- # Continue long-term monitoring to develop performance specifications acceptable to regulatory agencies in multiple states. This will allow for multiple deployments.
- # Deploy Evapotranspiration Cover/Integrated Fiber-Optic Performance Monitoring System at Albuquerque.
- # Complete deployment of advanced landfill cover at the Nevada Test Site.
- # Complete deployment and monitoring of phytoremediation stabilization of mixed waste plume at Argonne National Laboratory.
- # Continue evaluation of alternative cap and cover material and develop risk based cover design manual.

Source Term Containment/Source Term Remediation	9,778	6,604	5,372

(dollars in thousands)

FY 1998	FY 1999	FY 2000

Metals and Radionuclides in the Vadose and Saturated Zones

Metals and radionuclides contamination is present in the vadose and saturated zones at all DOE Operations Offices. Current technologies for the treatment of metals and radionuclides typically include excavation followed by ex situ treatment or pump-and-treat. These methods are costly, ineffective, and involve risk to workers. In addition, they are inadequate for attainment of the *Accelerating Cleanup: Paths to Closure* goals. Limited access to contaminants and low contaminant mobility at Albuquerque, Chicago, Oak Ridge, Rocky Flats, and Richland require reactive barrier technologies that remove or destroy radionuclide and hazardous metal contaminants moving in groundwater. To effectively address the existing site needs, solutions also must be developed that eliminate/reduce the volume of secondary waste and reduce workers' exposure. Partnerships with industry, the Environmental Protection Agency, the Department of Defense and other Federal agencies will lead to the cost effective development of in situ chemical treatment technologies that convert contaminants to less hazardous states and to the development of effective metal and radionuclide treatment/removal technologies based on bioremediation. In situ bioremediation technologies and improved drilling technology for sampling, delivery of treatment chemicals, or contaminant removal will be demonstrated. Existing access, sampling, and delivery methods cannot place characterization and treatment technologies in DOE's deep plumes. These plumes will be the most costly to remediate due to contaminant depth and geologic complexity. Improved technologies are needed to address these deep contaminants.

In FY 2000, there are six distinct work elements which support this Product Line: 1.) Vadose and Saturated Zone Characterization, Monitoring, Modeling and Analysis; 2.) In Situ Passive and Reactive Barrier Systems; 3.) Advanced Bioremediation and Enhanced Natural Attenuation; 4.) Vadose Zone Chemical Treatment Targeted for Metals and Radionuclides; 5.) Saturated Zone Chemical Treatment Targeted for Metals and Radionuclides; 6.) Deep Subsurface Access and Placement for Metals and Radionuclides.

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
# Continue development of improved characterization and monitoring techniques.			
# Continue development of vadose zone contaminant fate and transport models.			
# Perform verification of Reactive Barrier Technology System at Rocky Flats. Deploy system at three to four other Rocky Flats Operable Units if performance is good.			
# Perform verification of Reactive Barrier Technology System at Oak Ridge Y-12/S-3 Ponds.			
# Perform verification of Iron Treatment Wall at Kansas City "Northeast Area" Plume.			
# Perform verification of PERT Wall at Grand Junction, Monticello, Utah Uranium Mill Tailings Remedial Action Plume.			
# Deploy monitored natural attenuation at a Brookhaven site for tritium treatment.			
# Deploy phytoremediation at a site at Fernald and Idaho National Engineering and Environmental Laboratory.			
# Develop strategies and technologies to monitor the natural attenuation processes.			
# Deploy in situ Gaseous Reduction technology at Hanford.			
# Continue development of in situ soil flushing technology for mobilization/extraction of radionuclides and hazardous metals.			
# Deploy ACT*DE*CON at the Nevada Test Site.			
# Deploy Chemical Stabilization technologies in Vadose Zone at Hanford in support of the vadose integration and Columbia River Protection efforts.			
# Deploy in situ Redox Manipulation System for chromium treatment at Hanford.			
# Demonstrate mixed metal/radionuclide treatment technology in complex hydro-geologic setting at Albuquerque. (Industry solicitation).			
Metals and Radionuclides in the Vadose and Saturated Zones . . .	10,370	10,005	10,879
Total, Subsurface Contaminants Focus Area	32,870	31,611	35,080

Explanation of Changes from FY 1999 to FY 2000

	FY 2000 vs FY 1999 ($000)
Dense Non-Aqueous Phase Liquids (Delineation, Removal or In Sit Treatment)	
# Increase supports activities to develop, demonstrate and deploy technologies for the characterization and delineation of Dense Non-Aqueous Phase Liquids in the vadose zone and deep, complex geologic settings	3,827
Source Term Containment/Source Term Remediation	
# Decrease primarily due to completion of multi-year activity performed in cooperation wit the Environmental Protection Agency to improve landfill caps, covers and barriers to prevent the migration of wastes from DOE sites	-1,232
Metals and Radionuclides in the Vadose and Saturated Zones	
# Slight increase primarily related to technology development activities to characterize, monitor, and chemically treat contaminants in the vadose and saturated zones	874
Total Funding Change, Subsurface Contaminants Focus Area	3,469

Deactivation and Decommissioning Focus Area

Mission Supporting Goals, and Objectives

Program Mission

The mission of the Deactivation and Decommissioning Focus Area is to provide technical capabilities and deployment assistance, in partnership with other Environmental Management programs, to provide fully integrated, technically defensible solutions for deactivation, decommissioning, and long-term stewardship of radioactively contaminated facilities at DOE sites.

Program Goal

The goal of the Deactivation and Decommissioning Focus Area is to efficiently and cost effectively develop, demonstrate and facilitate the implementation of safe/low risk systems to solve the EM program identified needs for acceptable deactivation and decommissioning of DOE's radioactively contaminated surplus facilities. The overall goal of the Focus Area is to reduce the estimated $12 billion deactivation and decommissioning mortgage as reported in the *Accelerating Cleanup: Paths to Closure* by 50 percent. Two-thirds of the estimated $12 billion in deactivation and decommissioning work is scheduled for post-2006. The Focus Areas' goal is to reduce the pre-2006 mortgage of approximately $4 billion by $1 billion and the post-2006 mortgage (nearly $8 billion) by $5 billion. Within the funding provided, this Focus Area will assist in the development of alternative technologies at individual sites and implement and maintain sound program management and integration processes to achieve the cost savings and risk reduction goals.

Program Objectives

The Deactivation and Decommissioning Focus Area objective is to use a Large-Scale Demonstration and Deployment Project approach. This approach focuses on specific, high priority deactivation and decommissioning projects identified by and co-funded with the facility's owner. The Large Scale Demonstration and Deployment Projects demonstrate innovative and improved deactivation and decommissioning technologies at full scale, side by side with existing baseline technologies. The intent is to compare benefits from using a suite of innovative deactivation and decommissioning technologies against those associated with baseline technologies. Primary drivers of this work are the reduction of risk to workers involved in the cleanups, and the recycle (where feasible) or reduction of the large amounts of waste generated from the deactivation and decommissioning activities.

Performance Measures

The Science and Technology FY 2000 corporate performance metrics (30 technologies or technology systems demonstrated; 30 technologies or technology systems made available for implementation; 60 alternative technologies deployed) are set at the Project Baseline Summary level, based on past program performance and budget requested. The complete listing of specific technologies, by focus area, that will be demonstrated, made ready for implementation or deployed, is made available after Final FY 2000 project level funding is known and FY 2000 annual performance plans are finalized by each Focus Area. FY 2000 annual performance plans are scheduled to be finalized by September 30, 1999.

Significant Accomplishments and Program Shifts

- Completed, in FY 1998, C-Reactor Interim Safe Storage project at Hanford. Hanford has already incorporated the results from the C-Reactor project into F- and DR-Reactor safe storage projects. It is estimated that the cumulative cost of safe storing all of DOE's production reactors will be less than full deactivation and decommissioning of one reactor.
- Complete, in FY 2000, a Large Scale Demonstration and Deployment Project initiated in FY 1998 to deactivate and decontaminate a tritium production facility at Mound. This large Scale Demonstration and Deployment Project will showcase 8-12 innovative technologies for remote characterization and decontamination and dismantlement of tritium-contained equipment and surfaces.
- Deploy, in FY 2000, in fuel pools at Hanford and Idaho, underwater visual inspection, characterization, and remote dismantlement technologies to reduce safety and exposure risk to workers in high radiation environments.
- Deploy, in FY 2000, technologies to rapidly characterize and separate contaminated and non-contaminated metals at Oak Ridge, Rocky Flats, Los Alamos National Laboratory, and potentially other DOE sites to reduce waste disposal costs.
- Develop and demonstrate, in FY 2000, real-time characterization and robotic dismantlement technologies to reduce worker risk in the highly radioactive and confined areas associated with fuel fabrication facilities at Hanford.
- In FY 2000, increased program emphasis will be on recycle and release of scrap metal and technologies for the deactivation and decommissioning of reprocessing and weapons components fabrication facilities.

Funding Schedule

(dollars in thousands)

	FY 1998	FY 1999	FY 2000	$ Change	% Change
Reactor Facilities	6,637	6,460	4,733	-1,727	-26.7%
Radionuclide Separation Facilities	10,893	5,145	6,525	1,380	26.8%
Fuel and Weapons Component Fabrication Facilities	2,152	5,382	5,854	472	8.8%
Laboratory Facilities	9,784	5,951	0	-5,951	-100.0%
Total, Deactivation and Decommissioning Focus Area	29,466	22,938	17,112	-5,826	-25.4%

Detailed Program Justification

(dollars in thousands)

FY 1998	FY 1999	FY 2000

Reactor Facilities

There are 14 surplus production reactors across the DOE weapons complex which represent a significant portion of the Department's long-term deactivation and decommissioning mortgage. Improved, innovative technologies are required to facilitate deactivation and decommissioning of these production reactors to a degree such that they can be put in interim safe storage for a long period of time (up to 50 years) with minimal surveillance and maintenance requirements.

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
Technologies will be demonstrated and deployed which address underwater visual inspection, characterization and dismantlement as well as removal and treatment of fuel pool sludges, debris and water. These improved/innovative technologies will reduce the worker risk in high radiation fuel pools and significantly reduce the cost of deactivation and decommissioning of such facilities. Technologies demonstrated should substantially assist the future deactivation of the K-basin at Richland, as well as assist the commercial nuclear utility industry which also faces deactivation and decommissioning of similar complex facilities. For this reason, the commercial nuclear utility industry will be a key participant and be directly involved in this effort. Without these technologies, DOE sites and private industry will have no alternative but to adhere to their original technical baselines which will incur high cost, unacceptable worker risk, and long project duration to complete deactivation and decommissioning of these facilities.			
In FY 2000, there is one distinct work element which supports this Product Line: 1.) Deactivation and Decommissioning of Fuel Pools and Associated Structures.			
# Demonstrate and deploy underwater visual inspection and characterization technologies at Hanford K-Basin			
# Demonstrate and deploy underwater remote dismantlement technologies.			
# Demonstrate and deploy technologies using controlled explosion for dismantlement of massive structures.			
Reactor Facilities	6,637	6,460	4,733

Radionuclide Separation Facilities

Improved, innovative technologies are required to deactivate and decommission radionuclide separation facilities, including gaseous diffusion plants, fuel reprocessing canyons and a wide variety of specific types of facilities (such as chemical separation, uranium recycling, lithium enrichment, heavy water production and tritium production).

(dollars in thousands)

FY 1998	FY 1999	FY 2000

Deactivation and decommissioning activities can enable recovery of valuable contaminated scrap metal. At present, most of these metals are disposed of as no technologies exist to characterize and/or decontaminate them for free release cost-effectively. Decontamination of metals for recycle for free release will result in substantial life-cycle costs savings. Technologies to characterize, separate (contaminated and non-contaminated portions), and decontaminate metals for internal DOE recycle or free release will be demonstrated and deployed. Without this effort, most of the metals generated during deactivation and decommissioning will be disposed of as low-level waste resulting in high life-cycle cost.

Processing facilities are typically massive in size, are aging structures, and have high levels of contamination. These facilities have been used to process materials and treat waste containing plutonium, uranium, and various hazardous materials. Removal and disposition of radioactive and hazardous materials and equipment, deactivation of non-essential systems and utilities, and reconfiguration of systems to facilitate long-term surveillance and maintenance within these facilities with baseline technologies are very costly and pose high safety and health risks for workers and the public. Technologies will be demonstrated and deployed which address characterization of specific contaminants, accomplish large-scale decontamination and dismantlement, and waste disposition, enhance worker safety, and utilize remote operations.

In FY 2000, there are two distinct work elements which support this Product Line: 1.) Scrap Metal Recycling and Release; and 2.) Deactivation and Decommissioning of Processing Facilities.

- Demonstrate and deploy technologies to rapidly characterize and separate contaminated and non-contaminated metals at Oak Ridge.
- Demonstrate and deploy melting technology for producing clean ingots of stainless steel and nickel from contaminated feed at Oak Ridge.
- Develop and demonstrate real-time characterization technologies at Los Alamos National Laboratory and Rocky Flats.

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
# Develop and demonstrate robotic dismantlement technologies for process equipment at Rocky Flats.			
Radionuclide Separation Facilities	10,893	5,145	6,525

Fuel and Weapons Component Fabrication Facilities

Improved and innovative technologies are required to deactivate and decommission fuel and weapons component fabrication facilities including those used for uranium milling and refining, fuel and target fabrication, and weapons assembly, dismantlement, modification and maintenance. Cost and risk of using baseline technologies for deactivation and decommissioning of these facilities is staggering. Improved, innovative technologies will be demonstrated and deployed which address the cost effective characterization, decontamination and dismantlement of such facilities.

DOE's Mound facility has many structures which contain tritium contamination. Improved and innovative technologies will be demonstrated and deployed to address building decontamination/dismantlement and metal/concrete waste disposal/recycling. Without these technologies, the Mound facility and other DOE sites will be forced to adhere to original technical baseline that will increase the risk to workers and increase the cost and time needed for deactivation and decommissioning.

In FY 2000, there are two distinct work elements which support this Product Line: 1.) Deactivation and Decommissioning of Tritium Contaminated Facilities; and 2.) Deactivation and Decommissioning of Weapons Components Fabrication Facilities.

- # Demonstrate and deploy tritiated pump oil disposition technology.
- # Demonstrate and deploy dust suppression technology.
- # Demonstrate and deploy tritiated glovebox decontamination technology at Mound.
- # Develop and demonstrate remotely deployed real-time characterization technologies at Hanford.
- # Develop and demonstrate remote decontamination technologies at Hanford.

	(dollars in thousands)		
	FY 1998	FY 1999	FY 2000
Fuel and Weapons Component Fabrication Facilities	2,152	5,382	5,854

Laboratory Facilities

Innovative and improved technologies are required to deactivate and decommission laboratory facilities including research, development and testing facilities, hot cells and gloveboxes.

Across the DOE weapons complex, there is a large number of surplus plutonium contaminated gloveboxes. Technologies for characterization of contaminated surfaces to determine transuranic, low-level waste or free-release segregation and packaging of transuranic contaminated waste will be demonstrated and deployed. This will minimize the amount of glovebox material requiring disposal as transuranic waste.

This activity will not be continued into FY 2000.

Laboratory Facilities	9,784	5,951	0
Total, Deactivation and Decommissioning Focus Area	29,466	22,938	17,112

Explanation of Funding Changes from FY 1999 to FY 2000

	FY 2000 vs FY 1999 ($000)
Reactor Facilities	
# Continue, at a reduced level, technology development efforts related to inspection, characterization, and dismantlement needs associated with fuel pools and other structures	-1,727
Radionuclide Separation Facilities	
# Increase supports efforts to develop, demonstrate and deploy technologies to characterize and separate contaminated and non-contaminated metals and develop and demonstrate robotic dismantlement technologies for process equipment	1,380

	FY 2000 vs FY 1999 ($000)
Fuel and Weapons Component Fabrication Facilities	
# Increase supports activities to develop, demonstrate and deploy improved characterization, decontamination and dismantlement technologies required for cleanup of the Department's fuel weapons component fabrication facilities. (+$560); Increase offset by slight decrease related to planned completion in FY 2000 of Large Scale Demonstration and Deployment Project to deactivate and decontamination a tritium production facility at Mound. (-$88)	472
Laboratory Facilities	
# Decrease due to discontinuation, in FY 2000, of characterization and decontamination technology development activities related to transuranic contaminated materials and waste disposition	-5,951
Total Funding Change, Deactivation and Decommissioning Focus Area	-5,826

Plutonium Stabilization and Disposition Focus Area

Mission Supporting Goals, and Objectives

Program Mission

The mission of the Plutonium Stabilization and Disposition Focus Area is to provide technical capabilities and deployment assistance, in partnership with other Environmental Management programs, to provide fully integrated, technically defensible solutions for cleanup and long-term stewardship of plutonium materials and residues at DOE sites.

Program Goal

The Secretary of Energy has made commitments to the Defense Nuclear Facility Safety Board in response to Defense Nuclear Facility Safety Board Recommendation 94-1 that the Department will develop and deploy technologies to stabilize and dispose of plutonium and plutonium residues. More than 20 tons of plutonium and 170 tons of plutonium residues remain in the weapons manufacturing "pipeline" at several DOE sites such as Rocky Flats, Hanford, and Savannah River. Plutonium and plutonium residues will continue to pose imminent environmental, safety, and health hazards until they are incorporated into stable, safeguards-compatible waste forms and final disposition is completed. Similar quantities of unstabilized material exist in the former Soviet Union. The goal of the Plutonium Stabilization and Disposition Focus Area is to develop appropriate stabilization and waste treatment technologies, devise packaging, and support development of necessary transportation, storage, surveillance, and monitoring technologies. Within the funding provided, this Focus Area will assist in the deployment of alternative technologies at individual sites and implement and maintain sound program management and integration processes.

Program Objectives

Continue to develop technologies that address the stabilization and disposition of plutonium and plutonium residues across the complex. Deploy stabilization and disposition technologies as rapidly as possible to meed Defense Nuclear Facilities Safety Board 94-1 requirements and to support *Accelerating Cleanup: Paths to Closure* goals.

Performance Measures

The Science and Technology FY 2000 corporate performance metrics (30 technologies or technology systems demonstrated; 30 technologies or technology systems made available for implementation; 60 alternative technologies deployed) are set at the Project Baseline Summary level, based on past program performance and budget requested. The complete listing of specific technologies, by Focus Area, that will be demonstrated, made ready for implementation or deployed, is made available after final FY 2000 project level funding is known and FY 2000 annual performance plans are finalized by each Focus Area. FY 2000 annual performance plans are scheduled to be finalized by September 30, 1999.

Significant Accomplishments and Program Shifts

- Complete, in FY 1999, development of nonintrusive, automated surveillance and monitoring technologies.
- Demonstrate, in FY 2000, Phosphate-bonded cold ceramic technology at Rocky Flats to stabilize plutonium ash residue, a Defense Nuclear Facilities Safety Board identified concern.
- Test, in FY 2000, porous crystalline matrix technology to stabilize actinide solutions including plutonium, americium, and curium solutions at Savannah River F-Canyon.
- In FY 2000, program emphasis will be on development of stabilization technologies needed to address problems at Rocky Flats and Savannah River.

Funding Schedule

(dollars in thousands)

	FY 1998	FY 1999	FY 2000	$ Change	% Change
Plutonium Stabilization Technology Development	0	3,893	3,653	-240	-6.2%
Alternative Stabilization Process for Fissile Materials Solutions	0	0	600	600	100.0%
Alternate Packaging and Storage Technologies	0	1,587	0	-1,587	-100.0%
Total, Plutonium Stabilization and Disposition Focus Area	0	5,480	4,253	-1,227	-22.4%

Detailed Program Justification

(dollars in thousands)

FY 1998	FY 1999	FY 2000

Plutonium Stabilization Technology Development

Stabilization process development applies to plutonium and Defense Nuclear Facility Safety Board 94-1 materials (plutonium solutions, plutonium metals and oxides, plutonium residues, highly enriched uranium, and special isotopes) that require stabilization before being placed in interim storage to await ultimate disposition. The complexity of the at-risk Defense Nuclear Facility Safety Board 94-1 plutonium inventory and the variety of physical forms (such as oxides, salts, ash and solutions) creates need for additional research and development.

Plutonium residue stabilization is a critical path item at Rocky Flats. Accelerated cleanup goals and innovative technologies are needed to meet cleanup schedule. High-efficiency particulate air filters containing plutonium are a problem since incineration and leaching approaches are unacceptable. Technologies will be demonstrated and deployed which address high-efficiency particulate air filters, Uranium-233 Stabilization, Uranium-235 Stabilization and salt distillation at Rocky Flats. The impact if these technologies are not developed and implemented would be an increased risk to health, safety and the environment.

In FY 2000, one distinct work element supports this Product Line: 1.) Plutonium Ash and Filter Stabilization.

- **#** Deploy in collaboration with Office of Science and Technology Robotics program, Phosphate – Bonded Cold Ceramic technology at Rocky Flats to stabilize 20 tons of ash residue.
- **#** Full Scale demonstration of melting fiberglass filters at low temperature in a glass flux to evaluate acceptability as a stabilization process.

Plutonium Stabilization Technology Development	0	3,893	3,653

(dollars in thousands)

FY 1998	FY 1999	FY 2000

Alternative Stabilization Process for Fissile Materials Solutions

An alternative technology to vitrification is needed to address the problem of liquids containing americium and curium that produces reduced secondary waste, and that is reliable and cost effective. The new technology must reduce risk to safety, health, and environment.

Approximately 15,000 liters of solution containing isotopes of Americium and Curium are stored at the Savannah River Site in F-Canyon Tank 17-1. The original intent was to immobilize the Americium/Curium solution by vitrification in a bushing melter commencing in September 1998. Initial failures of the melter pushed the stabilization process into early FY 2000. Technical issues with the melter concerning plugging and off-gas caused all research and development efforts to be placed on hold. A technology, recently developed in Russia which would use a porous crystalline matrix, is being investigated which absorbs liquids at room temperature, forming stable ceramic material, suitable for safe long-term storage and transportation. If this technology is not pursued as a potential primary stabilization process, and as an alternative to precipitation-vitrification option, the Americium/Curium solution would remain unstabilized and the current risk to safety, health and the environment will remain or potentially increase.

In FY 2000, one work element supports this Product Line: 1.) Americum and Curium Removal and Stabilization from F Canyon.

- # Test waste solutions containing actinide including plutonium, americium, and curium.
- # Support Savannah River Site testing using small scale of actual Americium/Curium solution.
- # Support Savannah River Site in scale-up tests with actual Americium/Curium solution.

Alternative Stabilization Process for Fissile Material Solutions . . .	0	0	600

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
Alternate Packaging and Storage Technologies			
Plutonium and other actinides are currently stored in various packages, tanks, piping, plastic containers, and metal containers. When production was terminated in 1989-1993, these materials were typically being held for staging into production processes. DOE-STD-3013 requires plutonium metals and oxides to be stored in dry atmospheres in hermetically sealed containers not containing organic materials. Surveillance of packages is required to ensure that container integrity is maintained and that all materials comply with environmental, safety, health, accountability, and control requirements. Surveillance and monitoring processes need to be standardized complex-wide. Nonintrusive surveillance methods are needed to minimize radiation exposure and cost associated with conventional methods (such as inspection by opening packages).			
# Technologies related to nonintrusive, automated surveillance and monitoring technology development will be completed in FY 1999.			
Alternate Packaging and Storage Technologies	0	1,587	0
Total, Plutonium Stabilization and Disposition Focus Area	0	5,480	4,253

Explanation of Funding Changes from FY 1999 to FY 2000

	FY 2000 vs FY 1999 ($000)
Plutonium Stabilization Technology Development	
# Continue, at a reduced level, stabilization technology development activities	-240
Alternative Stabilization Process for Fissile Materials Solutions	
# Increase supports initiation of testing of porous crystalline matrix technology to stabilize actinide solutions including plutonium, americium and curium solutions at Savannah River F-Canyon	600
Alternate Packaging and Storage Technologies	
# Decrease reflects completion, in FY 1999, of automated surveillance and monitoring technology development activities	-1,587
Total Funding Changes, Plutonium Stabilization and Disposition Focus Area	-1,227

University Programs

Mission Supporting Goals, and Objectives

Program Mission

The mission of University Programs is to support the Focus Areas by providing fundamental credible data related to the application of technologies, resolution of technical issues and system optimization.

Program Goal

The goal of University Programs is to support the Focus Areas through the involvement of the academic community in the development of credible data from non-conflicted, recognized experts in support of activities related to the acceptance of innovative technologies by the regulators and stakeholders.

Program Objectives

The objective of University Programs is to evaluate technologies, validate their applications, and assist in the resolution of technical issues in support of the Focus Area.

Performance Measures

The Science and Technology FY 2000 corporate performance metrics (30 technologies or technology systems demonstrated; 30 technologies or technology systems made available for implementation; 61 alternative technologies deployed) are set at the Project Baseline Summary level, based on past program performance and budget requested. The complete listing of specific technologies, by Focus Area, that will be demonstrated, made ready for implementation or deployed, is made available after final FY 2000 project level funding is known and FY 2000 annual performance plans are finalized by each Focus Area. FY 2000 annual performance plans are scheduled to be finalized by September 30, 1999.

Significant Accomplishments and Program Shifts

- Continue, in FY 2000, research in support of robotic technologies supporting the Mixed Waste Focus Area to allow autonomous glovebox material processing, material handling, volume reduction of gloveboxes and automated handling of shipping drums.

Continue, in FY 2000, research in support of the Subsurface Contaminants Focus Area to remove metals from soils using advanced phytoremediation technologies.

Continue, in FY 2000, research in support of the waste loading/glass formulation, alternative melter design, analytical high-level/low level waste glass standards, and long-term performance for the Radioactive Tank Remediation Focus Area.

Funding Schedule

(dollars in thousands)

	FY 1998	FY 1999	FY 2000	$ Change	% Change
Florida State University	1,600	2,215	1,900	-315	-14.2%
Mississippi State University	5,572	4,500	4,000	-500	-11.1%
Florida International University	5,000	5,000	5,000	0	>999.9%
Medical University of South Carolina	3,000	0	0	0	>999.9%
Tulane University	2,433	0	0	0	>999.9%
Robotics University Program	4,000	4,000	4,000	0	>999.9%
Electronics Recovery Recycle	0	2,000	0	-2,000	-100.0%
Mixed Waste/Subsurface Contaminants	0	1,500	0	-1,500	-100.0%
Total, University Programs	21,605	19,215	14,900	-4,315	-22.5%

Detailed Program Justification

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
Florida State University			
Facilitate partnerships with Eastern and Central European Institutes for the evaluation and transfer of European environmental technologies for application to DOE problems.			
# Conduct research to remove metals from soils using advanced phytoremediation technologies.			
# Conduct joint technology development with Russian and Central European organizations, support marketing of United States technologies throughout Central and Eastern Europe, and bring foreign technologies to the United States environmental cleanup effort.			
Florida State University	1,600	2,215	1,900
Mississippi State University			

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
Continue support to the Mixed Waste Characterization, Treatment, and Disposal, the Deactivation and Decommissioning, and the Radioactive Tank Waste Remediation Focus Areas.			
# Conduct applied research and development that will lead to new technologies and techniques to deactivate and/or decommission facilities currently deferred until after 2006.			
# Support development of robotic technologies to deactivate and decommission facilities such as Hanford Canyons and plutonium processing facilities.			
# Support development of robotic technologies to allow autonomous glovebox material processing.			
# Support development of robotic technologies for material handling, volume reduction of gloveboxes, and automated handling of shipping drums.			
Mississippi State University	5,572	4,500	4,000
Florida International University			
Continue to support the Deactivation and Decommissioning, Mixed Waste Characterization, Treatment and Disposal, and the Radioactive Tank Waste Remediation Focus Areas.			
# Conduct applied research and development that will lead to new technologies and techniques to deactivate and/or decommission facilities currently deferred until after 2006.			
# Conduct research in support of waste loading/glass formulation, alternative melter design, analytical high-level/low-level waste glass standards, and long-term performance test methods.			
# Conduct research in support of development of sludge mapping tools, high-level waste process monitors, advanced calcination, dissolution process for calcined waste, integrated chlorinated solvents, transuranic waste, and strontium solvent extraction process, spherical inorganic sorbents, electrochemical caustic recovery, and salt splitting of radioactive waste.			

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
# Conduct joint technology development with Latin American countries, support marketing of United States' technologies throughout Latin America, and bring foreign technologies to the United States environmental cleanup effort.			
Florida International University	5,000	5,000	5,000
Medical University of South Carolina			
Conduct research focusing on recognition, identification, mechanisms, quantification and prevention of adverse biological effect/human disease resulting from exposure to chemical agents in the environment.			
# This grant will be funded elsewhere in the Defense Environmental Restoration and Waste Management appropriation.			
Medical University of South Carolina	3,000	0	0
Tulane University			
Support activities to provide tools for technology evaluation to maximize assessment and management of risk reduction activities in the weapons complex. Support the Subsurface Contaminants Focus Area through the evaluations of the health of contaminated aquatic environments in the Mississippi River Basin.			
# This grant was completed in FY 1998			
Tulane University	2,433	0	0
Robotics University Program			
Consortium of Universities: Florida, Tennessee, New Mexico, Michigan and Texas that provide broad capabilities ranging from "basic" through "applied" research in support of specific projects across the DOE complex.			
# Support the development of robotic technologies and techniques to deactivate and/or decommission facilities currently deferred until after 2006.			

	(dollars in thousands)		
	FY 1998	FY 1999	FY 2000
# Support the development of robotic technologies to verify and prepare drummed waste for transfer to Waste Isolation Pilot Plant and technologies for segregation of transuranic and low-level waste.			
# Support the development of non-destructive examination end-effectors for tank closure and restricted access equipment for waste mobilization and transfer.			
Robotics University Program	4,000	4,000	4,000
Electronics Recovery Recycle			
In accordance with report language contained in the FY 1999 Conference Report to the Energy and Water Development appropriation, supports a consortium of private sector entities and the University of West Virginia that provides broad capabilities ranging from basic through applied research and development in areas related to the recycle and reuse of glass, metals, and plastics electronic components.			
# Activity will not be continued in FY 2000.			
Electronics Recovery Recycle	0	2,000	0
Mixed Waste/Subsurface Contaminants			
Supports activities to provide tools for the evaluation of innovative technologies, and limited technology development, that supports cleanup activities in the Mixed Waste and Subsurface Contaminants Focus Areas. Performer has not yet been selected.			
# Activity will not be continued in FY 2000.			
Mixed Waste/Subsurface Contaminants	0	1,500	0
Total, University Programs	21,605	19,215	14,900

Explanation of Funding Changes from FY 1999 to FY 2000

	FY 2000 vs FY 1999 ($000)
Florida State University	

	FY 2000 vs FY 1999 ($000)
# Continue facilitation activities, at a slightly reduced level, with Eastern and Central European Institutes for the evaluation and transfer of European environmental technologies for application to DOE problems	-315
Mississippi State University	
# Continue, at a slightly reduced level, deactivation, decommissioning, robotic material handling, and automated handling of shipping drums activities	-500
Florida International University	
# No change	0
Medical University of South Carolina	
# No change	0
Tulane University	
# No change	0
Robotics University Program	
# No change	0
Electronics Recovery Recycle	
# Activities that support research and development related to recycle and reuse of glass, metals and plastic electronic components will not be continued in FY 2000	-2,000
Mixed Waste/Subsurface Contaminants	
# Activities to provide tools for the evaluation of innovative technologies to support cleanup activities in the Mixed Waste and Subsurface Contaminants Focus Areas will not be continued in FY 2000	-1,500
Total Funding Change, University Programs	-4,315

Idaho Technology Validation and Verification Program

Mission Supporting Goals, and Objectives

Program Mission

The mission of the Idaho Technology Validation and Verification Program is to support the Focus Areas and the Environmental Management program through technology validation and verification activities that support and enhance application and deployment of innovative EM technologies across the DOE complex and systems engineering activities which will be used in the development of disposition processes for each EM waste stream. These activities will place DOE's environmental programs on a solid technical base, reduce costs, and leverage the DOE investment into broader national environmental priorities.

Program Goal

The goal of the Idaho Technology Validation and Verification Program is to provide the Focus Areas and Environmental Management program processes that will assist EM in focusing activities on accelerating cleanup; investigating alternatives to the identified baseline using innovative technologies; and tracking performance of these efforts.

Program Objectives

The primary objective of the Idaho Technology Validation and Verification Program is to support EM in identifying and analyzing complex-wide integration opportunities to reduce program costs and risks.

Performance Measures

No quantifiable corporate performance measures are associated with this program.

Significant Accomplishments and Program Shifts

- Continue, in FY 2000, systems engineering support for assessment and validation of EM systems and technology performance reliability/risk.

Continue, in FY 2000, research activities to support EM missions identified from disposition maps priority needs, including research in materials and structural dynamics; materials characterizations science; environmental surface chemistry; containment transport through soils; liquid media and the atmosphere; and mathematical and computational modeling of complex environmental systems.

Continue, in FY 2000, identification of disposition barrier to technology development requirements, and transportation system requirements to support disposition of EM waste, spent nuclear fuel, and nuclear materials.

Funding Schedule

(dollars in thousands)

	FY 1998	FY 1999	FY 2000	$ Change	% Change
Validation and Verification	14,500	5,500	14,500	9,000	163.6%
Systems Engineering	0	8,000	8,000	0	>999.9%
Total, Idaho Technology Validation and Verification Program	14,500	13,500	22,500	9,000	66.7%

Detailed Program Justification

(dollars in thousands)

FY 1998	FY 1999	FY 2000

Validation and Verification

Technology validation and verification activities will be used to support and enhance application and deployment of innovative technologies across the DOE complex and to provide a solid technical base for EM cleanup, reduce costs and leverage the DOE investment into broader national environmental priorities.

Continue coordination of research activities with EM Integration and Focus Areas and interface with Site Technology Coordinating Groups to maintain and update data on specific science and technology needs.

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
# Execution of selected research activities to support EM mission extrapolated from disposition maps priority needs. Activities will include research in materials and structured dynamics; materials characterization science; environmental surface chemistry; containment transport through soils, liquid media, and the atmosphere; and mathematical and computational modeling of complex environmental systems.			
# Continue development of integrated, multidisciplinary technical research teams focused on environmentally related research and development including materials and structured dynamics; materials characterization science; environmental surface chemistry; containment transport through soils, liquid media, and the atmosphere; and mathematical and computational modeling of complex environmental systems.			
# Systems engineering support for application and extension of capabilities for assessment and validation of EM systems and technologies performance reliability/risk, and for facilitation of regulatory and stakeholder acceptance in support of deployment and life-cycle assurance.			
# Rapid deployment of scientific, technical and system engineering response teams to address national/complex-wide issues (for example, the vadose zone at Richland).			
Validation and Verification	14,500	5,500	14,500

Systems Engineering

(dollars in thousands)

FY 1998	FY 1999	FY 2000

Systems Engineering activities will be used in the refinement of EM waste, spent nuclear fuel, and nuclear materials disposition baselines, and identify and implement new opportunities to accomplish more efficient and cost effective cleanup/closure of DOE sites. Systems engineering activities provide the information and communication tools necessary to maximize the use of existing facilities, share technical information, minimize duplication, promote cost savings, and utilize a systems approach to facilitate accelerated cleanup while reducing closure costs and risks. Utilization of systems engineering processes brings together EM waste, spent nuclear fuel, and nuclear materials management, site cleanup, transportation, and Science and Technology activities. EM integration cuts across program and site "stovepipes", interfaces with other Departmental programs, and evaluates cross-site and cross-program opportunities for efficiencies and cost reductions to streamline and implement accelerated cleanup.

The EM Integration activity utilizes multi-site teams to develop, evaluate, and recommend alternatives to existing waste, spent nuclear fuel, and nuclear materials disposition baselines. DOE and contractor management personnel and subject matter experts from DOE EM sites are represented during the integration process. These activities are fundamental to the EM integration effort to establish and communicate a credible waste, spent nuclear fuel, and nuclear materials disposition baseline, and identify, evaluate, and implement selected efficiency opportunities.

- # Continue support to DOE-HQ, Field Offices, and contractors in development and integration of EM waste, spent nuclear fuel, and nuclear material disposition baselines.
- # Continue identification of barriers to disposition, technology development requirements, and transportation system requirements to support disposition of EM waste, spent nuclear fuel, and nuclear materials.
- # Identify cross-site and cross-program integration opportunities.
- # Perform technology development alternative analyses for integration opportunities.

	(dollars in thousands)		
	FY 1998	FY 1999	FY 2000
# Continue deployment of Integrated Product Teams to prepare Recommendation Evaluation Plans for selected waste, spent nuclear fuel, nuclear materials, technology development, and transportation opportunities for subsequent incorporation into project baselines.			
Systems Engineering	0	8,000	8,000
Total, Idaho Technology Validation and Verification Program	14,500	13,500	22,500

Explanation of Funding Changes from FY 1999 to FY 2000

	FY 2000 vs FY 1999 ($000)
Validation and Verification	
# In FY 1999, $9,000,000 is included for the Idaho Technology Validation and Verification Program within the Idaho Site Project Completion decision unit under the Defense Environmental Restoration and Waste Management appropriation account for a total of $22,500,000. Beginning in FY 2000, the funding request for this activity will be consolidated under the Science and Technology decision unit. There is no overall funding level change for this activity from FY 1999 to FY 2000	-9,000
Systems Engineering	
# See above explanation	0
Total Funding Change, Idaho Technology Validation and Verification Program	-9,000

Western Environmental Technology Office

Mission Supporting Goals, and Objectives

Program Mission

The mission of the Western Environmental Technology Office is to support the Mixed Waste Characterization, Treatment and Disposal Focus Area and the Subsurface Contaminants Focus Areas. For more than two decades, DOE has used the Western Environmental Technology Office as a test facility, where MSE Technology Applications, Inc. engaged in the research, testing, demonstration, development, and application of innovative technologies. In FY 1996, agreements were reached to privatize the Western Environmental Technology Office facility with a 5-year contract through 2001. Privatization will fulfill DOE's financial and management obligations and reduce the Government's costs in contracting services.

Program Goal

The goal of the Western Environmental Technology Office is to focus on testing technologies meeting high priority EM cleanup needs associated with the Mixed Waste Characterization, Treatment and Disposal Focus Area and the Subsurface Contaminants Focus Areas.

Program Objectives

The objective of the Western Environmental Technology Office is to support the Mixed Waste Characterization, Treatment and Disposal Focus Area and the Subsurface Contaminants Focus Area through the demonstration, testing, and evaluation of selected technology systems, performing life-cycle engineering analyses on innovative technology systems to maximize the chances of successful implementation and deployment.

Performance Measures

This program supports the Mixed Waste and Subsurface Contaminants Focus Area. As such, no quantifiable corporate performance measures are associated with this program.

Significant Accomplishments and Program Shifts

- Complete, in FY 2000, evaluation of off gas control and emission monitoring technologies as identified by the Mixed Waste Characterization, Treatment and Disposal Focus Area and the end users at Idaho, Oak Ridge, and Savannah River.
- Complete, in FY 2000, final documentation of the "as-built" performance for deployment of several of the radionuclide contaminated sites and continue monitoring and technical support for the barrier system applications throughout the DOE complex.
- Complete, in FY 2000, verification and documentation of in situ destruction techniques for Dense Non-Aqueous Phase Liquids demonstration at Cape Canaveral and initiate technology transfer performed with consortium (DOE, Department of Defense, United States Air Force, Environmental Protection Agency).
- Continue, in FY 2000, validation of cost savings estimates, including uncertainty analysis for deployed technologies across DOE complex.

Funding Schedule

(dollars in thousands)

	FY 1998	FY 1999	FY 2000	$ Change	% Change
Controlled Emissions Demonstration	4,600	3,500	3,500	0	>999.9%
Subsurface Contaminant and In Situ Remediation	7,495	7,250	4,300	-2,950	-40.7%
Engineering Analysis	1,298	2,250	2,704	454	20.2%
Total, Western Environmental Technology Office	13,393	13,000	10,504	-2,496	-19.2%

Detailed Program Justification

(dollars in thousands)

FY 1998	FY 1999	FY 2000

Controlled Emissions Demonstration

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
By 2002, the four operational DOE hazardous waste thermal treatment units must be able to meet the Environmental Protection Agency Maximum Achievable Control Technology Rule or be shut down. The Maximum Achievable Control Technology Rule states that a compliance plan must be submitted to the Environmental Protection Agency for covered operations within 180 days of promulgation of the rule (January 1999). Noncompliance with the Maximum Achievable Control Technology Rule will threaten DOE's ability to meet compliance agreements.			
Promising, technologically mature off gas monitoring and treatment systems, which are being tested under the Controlled Emissions Demonstration Project at Western Environmental Technology Office for organic and inorganic hazardous air pollutants should address this challenge of emission compliance by 2002.			
# Complete evaluation of off gas control and emission monitoring technologies as identified by the Mixed Waste Characterization, Treatment and Disposal Focus Area and the end users at the Idaho National Environmental Technology (New Waste Calcination Facility and the Waste Experimental Reduction Facility), Oak Ridge National Laboratory (Toxic Substances Control Act Incinerator) and the Savannah River Site (Consolidated Incineration Facility). Needs have been identified for furan/dioxin and volatile metals including mercury. Benefits include a design basis to support improved off gas systems and a flexible test bed readily available at Western Environmental Technology Office for continued off gas technology testing.			
Controlled Emissions Demonstration	4,600	3,500	3,500

Subsurface Contaminant and In Situ Remediation

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
Activities will support the Subsurface Contaminants Focus Area in addressing the problems/needs identified in the following areas: subsurface barrier systems, vadose zone stabilization, in situ passive treatment, deep access and delivery methods, containment/stabilization verification and monitoring. This investment directly supports Subsurface Contaminants Focus Area in its efforts to help meet all DOE Operation Offices' requirements, schedules and *Accelerating Cleanup: Paths to Closure* goals while directly contributing to cost reduction, schedule compression and risk minimization.			
# Complete the final documentation of the as-built viscous liquid barrier of the radionuclide contaminated site deployment; continue monitoring and provide technical support for barrier system applications throughout the DOE complex.			
# Complete verification and documentation of in situ destruction techniques for Dense Non-Aqueous Phase Liquids demonstration at Cape Canaveral and initiate technology transfer performed with consortium (DOE, Department of Defense, United States Air Force, Environmental Protection Agency).			
# Complete deployment of an alternative in situ vitrification system, verification, and documentation. Provide assistance in transferring this technology to more complex sites including those with containerized buried waste, organics, shallow groundwater and other technically challenging environments.			
# Complete methodology for rapid barrier construction performance evaluation and support its use throughout the complex.			
# Complete demonstration, validation and documentation of ultra microbacteria barrier and one or more deep (greater than 50 feet) treatment systems.			
# Complete demonstration, validation and documentation of reactive media for barriers and deep placement. Deploy media to projects using in situ passive treatment technologies.			
Subsurface Contaminant and In Situ Remediation	7,495	7,250	4,300

Engineering Analysis

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
Technical assistance and life-cycle systems analysis is critically important to achieving the successful deployment of treatment, remediation, and containment technology systems. These activities will focus on the analysis of technology systems which are ready candidates for implementation and deployment, matching newly developed technologies with DOE urgent cleanup needs to enhance deployment opportunities, and providing technical assistance to developers and users to assure successful deployment. Thus, this program will emphasize moving DOE funded technologies into the commercial setting either within the DOE complex or in private industry and accelerating innovative DOE technology acceptance at the local and regional level.			
# Provide independent innovative technology cost savings analysis for the Office of Science and Technology.			
# Provide Focus Areas with 10 (minimum) analyses of innovative technologies.			
# Validate cost savings estimates, including uncertainty analysis for deployed technologies across EM complex.			
# Report on status of MSE Technology Applications, Inc., evaluated technologies to deploy and commercialize. To include, but not limited to dioxin/furan and mercury off gas treatment and emission monitoring systems, reactive and containment barriers, barrier verification and monitoring systems, Dense Non-Aqueous Phase Liquids in situ treatment systems and alternative in situ vitrification.			
Engineering Analysis	1,298	2,250	2,704
Total, Western Environmental Technology Office	13,393	13,000	10,504

Explanation of Changes from FY 1999 to FY 2000

	FY 2000 vs FY 1999 ($000)
Controlled Emissions Demonstration	
# No change	0
Subsurface Contaminant and In Situ Remediation	

	FY 2000 vs FY 1999 ($000)
# Decrease related to the completion, in FY 2000, of several activities, such as: 1) final verification and documentation of in situ destruction techniques for Dense Non-Aqueous Phase Liquids demonstration at Cape Canaveral; complete deployment, verification and documentation of an alternative in situ vitrification system; complete final documentation of the as-built viscous liquid barrier of the radionuclide contaminated site deployment; and complete demonstration, validation and documentation of ultra microbacteria barrier and reactive media for barriers and deep placement	-2,950
Engineering Analysis	
# Increase supports technology cost savings analysis activities and selected innovative technology evaluation efforts	454
Total Funding Change, Western Environmental Technology Office	-2,496

Technology Acceptance and Support

Mission Supporting Goals, and Objectives

Program Mission

The mission of the Technology Acceptance and Support program is to provide business support to the Office of Science and Technology and to stimulate wider acceptance and deployment of emerging technologies for use in fully integrated, technically defensible solutions for cleanup and stewardship of DOE sites.

Program Goal

The goal of the Technology Acceptance and Support program is two-fold. First, the program is to provide the Office of Science and Technology with sound business assistance and effective information management. Second, the program is to facilitate wider acceptance and deployment of Focus Area technologies by timely analysis and provision of technology information to user sites and other stakeholders; as well as by activities that improve technical quality, responsiveness to site needs, and regulatory acceptance of Office of Science and Technology products, and leveraging of international science and technical expertise.

Program Objectives

The Technology Acceptance and Support program objectives are to provide effective business management controls and practices; technology and overall program information collection, analysis, and dissemination; program and peer reviews of technology initiatives; clarification of site science and technology needs and responsive Focus Area activities and technologies; facilitation of rapid technology deployment; support to interstate regulatory cooperation initiatives for the use of innovative technologies; facilitation of international science and technology cooperation; and recommendations for enhancing technology worker safety.

Performance Measures

No quantifiable corporate performance measures are associated with this program.

Significant Accomplishments and Program Shifts

- Continue, in FY 2000, to maintain information through the Technology Management System and other communication tools to aid in overall Office of Science and Technology business and program management and articulation.
- Update and continue, in FY 2000, life-cycle impact estimates for innovative technologies, with emphases on potential cost savings, using the EM standardized methodology which was developed under this program.
- Continue, in FY 2000, conducting independent reviews of Office of Science and Technology programs and significant processes and provide peer reviews of Office of Science and Technology technologies. In FY 1998 and FY 1999, over 70 technologies will have been peer reviewed under the methodology established in late FY 1997.
- Continue, in FY 2000, to assist all participating States in eliminating acceptance barriers to deployment through common protocols, training, improved state practices, and deployment workshops. Through FY 1999, this activity has been assumed under the sponsorship of the Environmental Commissioners of the States. Over 20 protocols and technology guidance documents have been issued.
- Continue, in FY 2000, update of site science and technology needs and responsive Focus Areas activities and technologies. Over 600 Science and Technology needs were identified for Focus Area response in FY 1999.
- Continue, in FY 2000, to provide recommendations for enhancing safety, reducing fatigue and stress, greater user acceptance, efficiency, and productivity for Office of Science Technology technologies.
- Reduce, in FY 2000, DOE funding requirements for Interstate Technology and Regulatory Cooperation workgroup by encouraging increased state, other Federal, private sector, and other funding participation.
- Continue, in FY 2000, to facilitate access to international expertise. In FY 1998 and FY 1999, approximately 25 international scientific and technical tasks will have been identified.

Funding Schedule

(dollars in thousands)

	FY 1998	FY 1999	FY 2000	$ Change	% Change
Program Information, Review and Analysis	4,379	6,451	6,050	-401	-6.2%
Regulatory and Site Acceptance	6,945	8,471	6,550	-1,921	-22.7%
International Technology Coordination	1,498	600	600	0	>999.9%
Safety Testing	0	2,000	1,700	-300	-15.0%
Total, Technology Acceptance and Support	12,822	17,522	14,900	-2,622	-15.0%

Detailed Program Justification

(dollars in thousands)

FY 1998	FY 1999	FY 2000

Program Information, Review, and Analysis

Activities will focus on sound business practices, program and peer reviews, and the Office of Science and Technology program data collection, analysis and dissemination. The Center for Acquisition and Business Excellence at the Federal Energy Technology Center assists the Office of Science and Technology with the implementation of its business management and control processes. Independent external peer and programmatic reviews will continue to enhance quality and acceptability of key Focus Area decisions and data. Program information and communications provides the Office of Science and Technology with the ability to collect, maintain, analyze, and disseminate key information to assist developers, site users, regulators, investors, and other stakeholders in key decisions. Credible estimates of cost savings and other innovative technology benefits promote increased acceptance of technologies by sites. In cooperation with other EM organizations, Technology Acceptance and Support develops methodologies for calculating life-cycle cost savings of new technologies. Total program impact on cleanup mortgage reduction projections are developed based on the EM strategy. Without these various programs and activities, EM decision makers would not have the information needed to support technology support or deployment decisions or to report impacts of deployments.

- # Continue providing all key Office of Science and Technology information through the Technology Management System and other communication tools to aid in overall Office of Science and Technology business and program management. Identify and meet the dynamic communication needs of existing and additional audiences as technology solutions mature. Institute improved management processes.
- # Update and continue life-cycle impact estimates for innovative technologies, with emphasis on potential cost savings, using the EM standardized methodology.

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
# Continue conducting independent review of Office of Science and Technology programs and significant processes, and provide peer reviews of Office of Science and Technology technologies.			
Program Information, Review, and Analysis	4,379	6,451	6,050

Regulatory and Site Acceptance

Regulatory and site acceptance are prerequisites to innovative technology deployment in support of the EM goal of accelerating cleanup. In the past, states have worked separately and have required duplicative demonstrations and inconsistent protocols to achieve permitting for local use, greatly slowing down multi-site deployments. Office of Science and Technology assists states through their Interstate Technology and Regulatory Cooperation work group in establishing verification protocols, reciprocity guidelines, and training to expedite multi-state permitting and multi-site deployments. Site acceptance of innovative technologies is facilitated by early clarification of site needs, by finding technologies to meet the needs, and by involving end users and stakeholders in the decision processes through such mechanisms as Site Technology Coordination Groups. This activity also provides for field management and reporting of management and operations activities supporting Office of Science and Technology, and assists coordination of planning efforts within the national laboratory community. This program further assists in technology acceptance and deployment at specific DOE cleanup sites as appropriate.

Continue to assist all participating states in eliminating acceptance barriers to deployment through common protocols, systems and training and deployment workshops. Reduce DOE funding requirements for Interstate Technology and Regulatory Cooperation workgroup by encouraging increased state, other Federal, private sector, and other funding participation. Continue to document use of Interstate Technology and Regulatory Cooperation workgroup publications and technology deployments.

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
# Update site science and technology needs, and continue to support management of site science and technology activities. Facilitate communications among site stakeholders and technology developers in order to catalyze the use of innovative science and technology solutions and pursue other activities to facilitate rapid deployment.			
Regulatory and Site Acceptance	6,945	8,471	6,550

International Technology Coordination

EM needs access to environmental technologies, scientific expertise, technical information, and foreign markets that can further DOE's cleanup mission. Through Memoranda of Cooperation, Office of Science and Technology collaborates with the scientific communities of Russia, Poland, Argentina and the United Kingdom in joint research and development to meet these needs. These efforts ensure continued awareness of opportunities for site users to access relevant foreign environmental technologies, data, and expertise to accelerate cleanup. Through these activities, Office of Science and Technology leverages the relationships established with the international science and technology community over the past 10 years to maintain access to foreign technologies with minimal increase in investment. Without these efforts, EM sites will not effectively receive the benefit of international technologies and expertise.

# Continue ongoing coordination and identification of available opportunities for EM participation with the international science and technology community. Level of effort for this activity will remain constant. Work is conducted with Argentina, Poland, Russia, and the United Kingdom under bilateral agreements.			
International Technology Coordination	1,498	600	600

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
Safety Testing			
DOE site cleanup work can be performed more responsibly and effectively through technology improvements that increase safety and contribute to user and worker acceptance of those technologies. Technology Acceptance and Support conducts worker safety assessments of high impact environmental technologies to improve technology safety, reduce worker fatigue and stress, increase comfort, and gain increased user and worker acceptance. Without this activity, user and worker acceptance may be reduced, potentially lessening benefits from Office of Science and Technology investments.			
# Continue to provide recommendations for enhancing safety, reducing fatigue and stress, greater user acceptance, efficiency, and productivity for Office of Science and Technology technologies.			
Safety Testing	0	2,000	1,700
Total, Technology Acceptance and Support	12,822	17,522	14,900

Explanation of Changes from FY 1999 to FY 2000

	FY 2000 vs FY 1999 ($000)
Program Information, Review, and Analysis	
# Slight decrease in communication activities	-401
Regulatory and Site Acceptance	
# Decrease reflects planned reduction, in FY 2000, for the Interstate Technology Regulatory Cooperation workgroup as other funding sources (state, other Federal, private sector, etc.) are developed and a reduction in deployment support	-1,921
International Technology Coordination	
# No change.	0
Safety Testing	
# Fewer worker safety assessments of Science and Technology technologies will be conducted	-300
Total Funding Change, Technology Acceptance and Support	-2,622

Small Business Innovative Research Program (Technology Development)

Mission Supporting Goals, and Objectives

Program Mission

Provide funding to the Small Business Innovative Research program for small businesses to participate in research and development activities that benefit the EM program.

Program Goal

The goal of this program is to use technologies developed by the small business community to accelerate and reduce the cost of cleanup at EM sites.

Program Objectives

The objective is to deploy technologies that meet the EM mission as rapidly as possible.

Performance Measures

There are no quantifiable corporate performance measures associated with this program.

Significant Accomplishments and Program Shifts

Continue to support this program and provide opportunities for the small business community to make contributions to the EM mission.

Funding Schedule

(dollars in thousands)

	FY 1998	FY 1999	FY 2000	$ Change	% Change
Small Business Innovative Research Program (Technology Development)	0	2,224	2,000	-224	-10.1%

Detailed Program Justification

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
Small Business Innovative Research Program (Technology Development)			
Funding is requested for the Small Business Innovative Research assessment in accordance with Public Law 102-564, which mandates a percentage of all research and development dollars be set aside for grants to small businesses. Once funding is appropriated, it is transferred to the DOE Office of Science for award and administration of grants to small businesses.			
Small Business Innovative Research Program (Technology Development	0	2,224	2,000
Total, Small Business Innovative Research Program (Technology Development	0	2,224	2,000

Explanation of Changes from FY 1999 to FY 2000

	FY 2000 vs FY 1999 ($000)
Small Business Innovative Research Program (Technology Development)	
# Decrease reflects lower assessment due to overall decrease to the Technology Development program research and development dollars from FY 1999 to FY 2000	-224
Total Funding Change, Small Business Innovative Research Program (Technology Development)	-224

Environmental Management Science Program

Mission Supporting Goals, and Objectives

Program Mission

The mission of the Office of Science and Technology's Science Program is to develop and fund a targeted long-term basic research program that will result in transformational or breakthrough approaches for solving the Department's environmental problems. This program is a collaborative effort between the Department's Office of Environmental Management and Office of Science.

Program Goal

The goal of the Office of Science and Technology's Science Program is to continue to solicit and support world class basic research that has the potential to lead to significant, quantum improvements in the understanding of scientific principles and phenomena in areas of interest to the EM mission; to validate existing technical solutions to complex problems; to provide technical solutions where currently there are none; and to lead to future risk reduction and cost and time savings.

Program Objectives

The objectives of the Office of Science and Technology Science program are to widely solicit research needs, and use an open, fair and competitive selection process to distribute research funding. Site-specific research needs have been solicited through a variety of activities including workshops at Richland, Savannah River Site, Oak Ridge, and Idaho National Engineering and Environmental Laboratory; a complex-wide needs survey; solicitation or science research needs in support of the *Accelerating Cleanup: Paths to Closure* plan from the Site Technology Coordinating Groups; and through systems engineering analysis performed by the Idaho National Engineering and Environmental Laboratory. The importance of basic scientific research to the EM cleanup mission has been established in several reports, specifically the Galvin Commission report (1995) entitled *Alternative Futures for the Department of Energy National Laboratories* and the National Research Council report (1996) entitled *Improving the Environment: An Evaluation of Doe's Environmental Management Program*. The Environmental Management Advisory Board Science Committee is supportive of the EM Science Program and its accomplishments in what has been a relatively short time of existence (i.e., the Environmental Management Science Program is up and running, employs a competitive and fair selection process, has distributed research funding, has research underway, and research to date looks favorable).

Performance Measures

No quantifiable corporate performance measures are associated with the program.

Significant Accomplishments and Program Shifts

- In May 1998, the Science Program received a “HAMMER” award from the Vice President’s National Performance Review Team.

In addition, major areas of scientific research needs addressed by the EM Science Program awards include:

- Advanced methods to characterize, remove, and treat high-level wastes in tanks.
- New approaches and methods for the decontamination and decommissioning of contaminated facilities and equipment.
- Identification of ways to reduce uncertainty in the long-term containment performance of spent nuclear fuel in storage and disposal.
- Advanced methods for conversion of fissile materials to more stable forms.
- Improved scientific information for the characterization, treatment, and monitoring of mixed radioactive and hazardous materials.
- New concepts for developing suitable storage forms for each type of waste that needs to be stored.
- Reduced scientific uncertainty in the levels of risk to human health at the end stages of cleanup efforts.
- New approaches and methods to address problems in subsurface contamination and transport processes in the vadose zone.
- Approaches to develop a better scientific basis for understanding exposures and risks to humans from low dose radiation that can be used to achieve acceptable levels of human health protection at the lowest possible cost.

As the EM Science Program matures it will continue to fund basic research and development to address the evolving science needs of EM sites. The program intends to ensure that it is addressing the right research questions, disseminating research results, and getting the "best science" by:

- Evaluating ongoing research.
- Communicating the nature of the program, and its research results, to as wide an audience as possible.
- Holding site-specific, and complex-wide workshops to link basic research developed within and outside the Department, with technology users, both within, and outside the Department. The first complex-wide workshop was held in July 1998 and the American Chemical Society will host a session

on the Environmental Management Science Program research at their national symposium in Summer 1999. A second complex-wide workshop is being planned Spring 2000.

- Developing a national science research plan based on needs identified by sites through the project baseline summaries. National Academy of Sciences/National Research Council will complete a plan for subsurface contamination in Fall of 1999.
- Coordinating and leveraging research efforts and capabilities with other DOE programs, other federal agencies, academia, and the private sector.

The EM Science program supports DOE's strategic goal to deliver the scientific understanding and technological innovations that are critical to the success of DOE's mission and the Nation's science base. The program directly supports the objective to develop the science that underlies DOE's long-term mission.

Funding Schedule

(dollars in thousands)

	FY 1998	FY 1999	FY 2000	$ Change	% Change
FY1996 Awards	23,139	20,512	0	-20,512	-100.0%
FY 1997 Awards	9,655	8,035	7,924	-111	-1.4%
Integration of Research Results into the Program	1,316	1,880	1,500	-380	-20.2%
FY 1998 Awards	12,000	3,379	10,400	7,021	207.8%
FY 1999 Awards	0	12,032	11,411	-621	-5.2%
Small Business Innovative Research Program	0	1,162	765	-397	-34.2%
Total, Environmental Management Science Program	46,110	47,000	32,000	-15,000	-31.9%

Detailed Program Justification

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
FY 1996 Awards			
In FY 1996, 136 three-year research projects at 52 universities, 11 Department of Energy National Laboratories and other private and public technology developers and researchers were initiated. Seventy-one of the projects focused on science needed to improve remedial action processes; 26 focus on finding better ways to treat and destroy high level radioactive waste, 23 focus on waste containing a mixture of radioactive and other hazardous materials (mixed waste); 10 focus on better understanding the health and ecological risks associated with environmental cleanup options; and the remaining 6 focus on technical problems with facility deactivation and decommissioning and spent nuclear fuel stabilization and disposal. The national laboratory research project funding is focused on problems in the areas of: subsurface contaminants (48%); radioactive tank waste (24%), mixed waste characterization, treatment, and disposal (15%), decontamination and decommissioning (4%), nuclear materials (2%), and health/ecology/risk (7%).			
# Complete, in FY 1999, grants initiated in FY 1996.			
FY 1996 Awards	23,139	20,512	0

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
FY 1997 Awards			
In FY 1997, 66 additional three-year research projects were initiated. Over half of the 66 award recipients are collaborative efforts among universities, laboratories and private industry. Of these projects, 28 will be led by universities; 31 by DOE National Laboratories; and 7 by private industry, nonprofit research centers, and other federal laboratories. Twenty-two of the projects focus on finding better ways to treat and destroy high level radioactive waste; nine focus on waste containing a mixture of radioactive and other hazardous materials; five focus on spent nuclear fuel treatment and destruction; and six address the materials used in weapons production (nuclear materials). The remaining 24 projects deal with the science needed to improve remedial action processes, to safely carry out deactivation and decommissioning of DOE sites, and to better understand the health and ecological risks associated with environmental cleanup options. The research funded at the national laboratories is focused on problems in the areas of: radioactive tank waste (43%), nuclear materials (18%), subsurface contaminants (14%), decontamination and decommissioning (8%), mixed waste characterization, treatment, and disposal (4%), spent nuclear fuel (4%), and research projects supporting multiple categories (9%).			
# Complete, in FY 2000, grants initiated in FY 1997.			
FY 1997 Awards	9,655	8,035	7,924
Integration of Research Results into the Program			
Management, analysis, and integration. Success of the EM Science Program is dependent on the application of scientific results in EM Focus areas and directly in field activities, enhancing EM's ability to meet compliance requirements.			
# Disseminate FY 1996, FY 1997, and FY 1998 research results to EM project managers based on science needs and problem areas and to potential technology developers. Provide links with DOE project managers, research community, and potential technology users.			

	(dollars in thousands)		
	FY 1998	FY 1999	FY 2000
# Conduct topical workshops and seminars on specific science topics and/or site specific topics to disseminate results in a timely manner. Conduce a second complex-wide workshop to link basic research developed in the program with technology developers.			
# Implement process to review the results of research awards from FY 1996 and FY 1997 to determine if the next step is additional follow-on basic research, applied research, incorporation of results directly into technology development, or direct application of results to an EM problem area.			
# Refine and improve long term site specific and national science research agenda on needs identified in EM's cleanup strategy and through EM's roadmapping effort.			
Integration of Research Results Into the Program	1,316	1,880	1,500

FY 1998 Awards

In FY 1998, 33 additional three-year research projects were initiated involving 23 universities, 6 DOE National Laboratories and 7 private industry or other federal laboratories, in 20 states. A total of two-thirds of the 33 award recipients are collaborative efforts among universities, laboratories and private industry. Of these projects, 9 will be led by universities; 22 by DOE National Laboratories; and 2 by private and other federal laboratories. Twenty of the projects focus on finding better ways to treat and destroy high level radioactive waste and 13 deal with the science needed to improve and safely carry out the deactivation and decommissioning of DOE sites. The research funded at the national laboratories is focused on problems in the area of radioactive tank waste (64%) and decontamination and decommissioning (36%).

# Continue to support grants in the areas of high level waste and decontamination and decommissioning.			
FY 1998 Awards	12,000	3,379	10,400

	(dollars in thousands)		
	FY 1998	FY 1999	FY 2000
FY 1999 Awards			
FY 1999 awards will be made by September 1999 to address scientific problems associated with vadose zone, subsurface contamination, and groundwater issues to support initiatives at sites such as Hanford and to develop a better scientific basis for understanding exposures and risks to humans from low dose radiation. Research will be selected based on its scientific merits and its relevance to the EM mission.			
# Continue to support research awards in the area of vadose zone, subsurface contamination and groundwater and in the area of exposures and risks from low dose radiation.			
FY 1999 Awards	0	12,032	11,411
Small Business Innovative Research Program			
# Assessment on research funds in accordance with Public Law 102-564.			
Small Business Innovative Research Program	0	1,162	765
Total, Environmental Management Science Program	46,110	47,000	32,000

Explanation of Funding Changes From FY 1999 to FY 2000

	FY 2000 vs FY 1999 ($000)
FY 1996 Awards	
# Decrease reflects completion, in FY 1999, of research grants initiated in FY 1996 . . .	-20,512
FY 1997 Awards	
# Decrease reflects completion, in FY 2000, of research grants initiated in FY 1997	-111
Integration of Research Results into the Program	
# Slight decrease in management, analysis and integration of research result activities . .	-380
FY 1998 Awards	
# Significant increase supports mortgages related to research grants awarded in FY 1998	7,021
FY 1999 Awards	
# Slight decrease supports mortgages related to research grants awarded in FY 1999 . . .	-621

	FY 2000 vs FY 1999 ($000)
Small Business Innovative Research Program	
# Decrease reflects reduced assessment due to the overall reduction of EM Science Program research and development funding from FY 1999 to FY 2000	-397
Total Funding Change, Environmental Management Science Program	-15,000

Environmental Management Risk Policy Program

Mission Supporting Goals, and Objectives

Program Mission

The mission of the Environmental Management National Risk Policy Program, through a partnership between the Center for Risk Excellence, located in Chicago, and the Headquarters Risk Policy Program is to develop policies and strategies to manage and reduce risks at the sites and to communicate risk information to stakeholders.

Program Goal

The overall goal of the Environmental Management National Risk Policy Program is to provide guidance, tools, technical support and training that result in credible risk-based environmental decisions which protect human health and the environment and involve meaningful stakeholder participation.

Program Objectives

The Environmental Management National Risk Policy Program will implement its goal by developing policy, assisting the field, interacting with stakeholders, and responding to internal and external information requests.

Performance Measures

No quantifiable corporate performance measures are associated with this program.

Significant Accomplishments and Program Shifts

- Creating tools and training for Project Managers to ensure that they can adequately convey risk management tradeoffs to stakeholders, and reach consensus-based decisions.
- Leveraging and coordinating risk research with research supported by other organizations inside and outside the Department of Energy (National Laboratories, Environmental Protection Agency, National Institute of Occupational Safety and Health, etc.)

- Providing technical support to EM's Field elements to implement a credible site-specific process for risk analysis, risk management, risk communication, and priority setting initiatives.
- Providing technical peer review and comments on scientific and technical risk materials, both internally and externally, through nationally recognized scientific and technical organizations.
- Integrating risk information into the planning process for establishing priorities among competing EM requirements, simplifying the use of risk in the budget priorities, and in facilitating the use of risk in measuring performance.
- Developing Site Hazard and Risk Profiles to identify human health, worker, ecological, and transportation risks and to delineate programmatic risks.
- Support research through a Cooperative Agreement with the Consortium for Risk Evaluation and Stakeholder Participation (CRESP, which is a partnership between the University of Medicine and Dentistry of New Jersey and the University of Washington). These independent institutions conduct research which is focused on national issues concerned with identifying and characterizing risks to human health and well-being; characterizing target ecosystems; linking the presence of contaminants with the endpoint; developing innovative approaches to the evaluation and protection of hazardous waste workers; and incorporating social cultural and economic impacts into the risk paradigm.
- In FY 1999, supporting research through an award with the Consortium for Environmental Risk Evaluation (CERE, which is a partnership between Tulane University and Xavier University). The research is focused on health and ecological risk analysis, risk assessment, risk communication, and risk management issues, including evaluation of stakeholder issues, design and evaluation methods for evaluating innovative technologies, and assessing risk associated with cleanup and long-term stewardship.

The program will integrate baseline risk information within a number of key topical risk areas and develop rosters of expertise, related materials, and action plans (with follow-ups), e.g., for facilitated enhancement of existing decision processes and information exchange with regard to critical lessons learned. This will involve coordinating experts from across the complex to develop solutions for specific risk issues, pursuant to a tiered response system that considers requests for assistance based on the urgency of the request and nature/extent of resources required. The program will support and promote the development and implementation of emerging technologies and cost-efficient, protective measures for reducing risk and mortgage costs.

This program supports DOE's strategic goal to aggressively clean up the environmental legacy associated with nuclear weapons production and civilian nuclear research and development programs, minimize future waste generation, safely manage nuclear materials, and permanently dispose of the nation's radioactive wastes. The program provides guidance and tools to assist the project managers in collection of the information that will ensure that high risk projects are prioritized and funded and that risk to workers, the public, and the environment continue to decrease over time.

It also supports DOE's commitment to ensuring the safety and health of the DOE workforce and members of the public, and the protection of the environment in all Departmental activities.

Funding Schedule

(dollars in thousands)

	FY 1998	FY 1999	FY 2000	$ Change	% Change
National Risk Policy Program	3,000	3,000	2,000	-1,000	-33.3%
University of Medicine and Dentistry of New Jersey and University of Washington (CRESP) Grant	4,000	4,000	3,000	-1,000	-25.0%
Center for Environmental Risk Evaluation (CERE) Grant at Tulane and Xavier Universities	0	2,000	0	-2,000	-100.0%
Total, Environmental Management Risk Policy Program	7,000	9,000	5,000	-4,000	-44.4%

Detailed Program Justification

(dollars in thousands)

FY 1998	FY 1999	FY 2000

National Risk Policy Program

The National Risk Policy Program, in partnership with the Chicago Center for Risk Excellence, develops risk-based decision making approaches, including guidance documents and metrics to measure risk reduction to meet goals established for EM under the Government Performance and Results Act and DOE strategic plan.

- # Continue activities to refine and implement policies and strategies to protect human health and the environment, and continue to involve stakeholders in the risk-based decision-making process. For example, develop new tools for decisions in decontamination and decommissioning activities and recycling of waste material, and facility re-use.
- # Implement a process to evaluate risks and hazards associated with the long term stewardship issues to protect the public and the environment, with issues related to worker safety, and with ecological risk.
- # Implement a process to assist the DOE field sites to measure progress toward risk reduction.
- # Work with sites to peer review risk related evaluations and assessments.

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
# Develop a web-based system to provide service-oriented environmental risk assessment expertise using a diverse set of risk tools.			
# Create a National Referral System listing academic, industrial, government, and national laboratory experts in all areas of risk.			
National Risk Policy Program	3,000	3,000	2,000

University of Medicine and Dentistry of New Jersey and University of Washington (CRESP) Grant

Support a cooperative agreement with the Consortium for Risk Evaluation and Stakeholder Participation (University of Medicine and Dentistry of New Jersey and University of Washington) to perform risk research and develop risk analysis tools to better understand the diverse cleanup risks found at major DOE sites such as Savannah River and Hanford.

Consortium for Risk Evaluation and Stakeholder Participation will complete research that addresses issues or problems in the following areas:

- Characterization of risks to human health
- Development of innovative approaches for the evaluation of risks associated with the protection of hazardous waste work;
- Development of techniques and approaches to assess the risk and effectiveness of environmental restoration and waste management alternatives;
- Improvement of methods and databases for linking the presence of contaminants with receptor endpoints;
- Integration of ecological risk methods into hazard identification;
- Development of criteria for preservation or restoration of ecological systems in relation to remediation alternatives.

University of Medicine and Dentistry of New Jersey and University of Washington (CRESP) Grant	4,000	4,000	3,000

(dollars in thousands)

	FY 1998	FY 1999	FY 2000
Center for Environmental Risk Evaluation (CERE) Grant at Tulane and Xavier Universities			
Support an award with the Center for Environmental Risk Evaluation (Tulane University and Xavier University) to perform research in risk assessment, risk management, and risk communication. Research to focus on evaluation of risks associated with stakeholder issues, long-term stewardship, and innovative environmental technologies.			
# Activity will not be funded in FY 2000.			
Center for Environmental Risk Evaluation (CERE) Grant at Tulane and Xavier Universities	0	2,000	0
Total, Environmental Management Risk Policy Program	7,000	9,000	5,000

Explanation of Funding Changes From FY 1999 to FY 2000

	FY 2000 vs FY 1999 ($000)
National Risk Policy Program	
# Decrease reflects reduced activity in the areas of: 1) development of new risk tools and training; 2) technical support to EM Field elements for site-specific processes for risk analysis, risk management, risk communication and priority setting initiatives; 3) technical peer review and comments on scientific and technical risk materials; and 4) integration of risk information into the planning process	-1,000
University of Medicine and Dentistry of New Jersey and University of Washington (CRESP) Grant	
# Decrease reflects reduced support for the Consortium for Risk Evaluation and Stakeholder Participation (CRESP) cooperative agreement	-1,000
Center for Environmental Risk Evaluation (CERE) Grant at Tulane and Xavier Universities	
# Grant will not be funded in FY 2000	-2,000
Total Funding Change, Environmental Management Risk Policy Program	-4,000